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POLICY RESEARCH WORKING PAPER

1442

Energy Price Increases in Developing Countries

Case Studies of Colombia, Ghana, Indonesia, Malaysia, Turkey, and Zimbabwe

Einar Hope
Balbir Singh

Six case studies show that raising energy prices to eliminate subsidies does not harm the poor, growth, inflation, or industrial competitiveness. And public revenues improve.

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Summary findings

When domestic energy prices in developing countries fall below opportunity costs, price increases are recommended to conserve fiscal revenue and to ensure efficient use of resources. Using six case studies, Hope and Singh investigate the effect of energy price increases on the poor, inflation, growth, public revenues, and industrial competitiveness.

The effect on households in various income classes depends on the energy commodity's share in the household budget and the price elasticity of demand. For energy as a whole (electricity and fuels, traditional and commercial), budget shares often decline with income. So in terms of income distribution, taxing energy is not ideal. But commercial fuel consumption increases greatly with income, so any subsidies applied will largely benefit nonpoor urban households. For each commercial energy source (electricity, kerosene, diesel, and gasoline) proportionate household spending will generally be lower, and some energy sources will be luxuries. In no instance does energy spending exceed 10 percent of the typical household budget for any income group.

The effect on industry is generally modest, since cost shares for energy typically range from 0.5 to 3 percent (with the typical value being 1.5). In addition, many industries are flexible enough to substitute when energy prices increase. Energy prices tended to increase in adjustment and liberalization programs, and industrial output usually increased even with the higher energy prices. This suggests that the effect of the price increase is modest compared with the effects of other changes in the environment. There are exceptions, of course, such as energy-intensive industries with limited possibilities for substitution.

Estimating the effects on public deficits is straightforward, even with uncertainty about demand elasticities: Energy price increases reduce the drain on public resources significantly.

It is harder to trace the effects on inflation and growth in national income. The effects on inflation will generally not be severe, and inflation may even be reduced in the intermediate to long run, through lowered public deficits. Income growth rates were generally higher after the years of energy price adjustments than they were in the years *before* the price increases (with one exception) and the years *of* the price increases (with one exception). Income growth rates were higher during the years of price increases than before in about half of the case-study countries.

This paper—a product of the Public Economics Division, Policy Research Department—is part of a larger effort in the department to study the distributional and environmental effects of energy pricing policies. The study was funded in part by the Bank's Research Support Budget under the research project "Pollution and the Choice of Economic Policy Instruments in Developing Countries" (RPO 676-48). Copies of this paper are available free from the World Bank, 1818 H Street NW, Washington, DC 20433. Please contact Carlina Jones, room N10-063, extension 37699 (91 pages). March 1995.

Energy Price Increases in Developing Countries:

Case Studies of Malaysia, Indonesia, Ghana, Zimbabwe, Colombia and Turkey

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SUMMARY AND CONCLUSIONS

The policy recommendation that domestic energy prices should reflect the scarcity of energy resources has been emphasized in a number of developing countries. However, while there seems to be general agreement about the costs of subsidizing energy, views differ concerning the economic and welfare consequences of increasing energy prices. Consequently, although some countries have increased energy prices, others continue to contemplate such changes with trepidation. This study draws on the recent experience of countries that have implemented domestic energy price increases and analyzes the economic consequences. These consequences can be categorized into two groups; (1) direct partial-impacts on producers and consumers, and (2) overall macroeconomic impacts of energy price increases. Direct partial-impacts include effects on costs, output and consumption in the industrial sector and impacts on consumption and welfare of household consumers. Macroeconomic impacts include effects on the general price level, government revenues, energy subsidies and aggregate output.

A sample of six countries, which implemented significant increases in prices of different fuels and electricity during the 1980s, was identified for detailed analysis: Malaysia, Indonesia, Ghana, Zimbabwe, Colombia and Turkey. The choice of countries was guided by factors such as income level, economic structure, geographic dispersion, and export or import of oil.

Impacts of Energy Price Increases: The Industrial Sector

The impact of an increase in the price of energy on industrial output depends on three parameters: (1) the importance of energy inputs in production as represented by energy cost shares, (2) the ease with which energy can be substituted by other inputs, and 3) the ability of the producers to pass on the increase in energy costs to the consumers, as measured by the elasticity of demand for output.

These parameters may vary across production activities and countries. With the exception of energy intensive activities such as metal- and non-metallic mineral products and pulp and paper, energy cost shares in most of the industries in the sample are relatively low, between 0.5 to 3 percent, with the modal value being around 1.5 percent. Shares for individual fuels are even lower, as most industrial activities use more than one type of fuel. We can distinguish between two types of substitution in response to a change in the fuel price: (1) a shift to cheaper fuels and (2) interfactor substitution as firms reduce energy use. Indonesia is the only country where information is available to assess substitution possibilities in industrial subsectors. However, in most of the countries energy consumption patterns reveal interfuel substitution. In particular,

in Malaysia, Indonesia and Turkey, a shift in favor of electricity is observed as domestic diesel prices increased. Although a part of this shift toward electricity can be explained by improved access to electricity supplies, a significant cross-price elasticity between diesel and electricity has also been observed in Indonesia. In Colombia, a shift in favor of gas can be observed as electricity prices increase. In general, the shift favors domestic energy resource endowments in these countries. Interfactor substitution from energy to labor has also been observed in Indonesia.

Table 1 summarizes changes in energy prices and industrial output. The responses varied across the countries in the sample. For Ghana and Indonesia, increased growth rates in manufacturing output is observed in the years of the price increases (Output Change II), as well as in the following years. In Malaysia (1984-85), Turkey (1988-89) and Zimbabwe (1982-83), sectoral growth rate fell during the years of price increases. In Zimbabwe, the fall in output was due to the response of the energy intensive industries to increases in electricity prices, in particular metal-smelting, where electricity is a large share of production costs and the possibilities for interfuel substitution are limited. Because of the competitive nature of the international metal markets, individual producers are price takers and have limited possibilities for passing on the increase in energy costs to consumers. In both Malaysia and Zimbabwe, there was a marked recovery in manufacturing output in the year following the reform as indicated in output III (table 1).

Table 1: Output Impacts of Energy Price Increases: The Industrial Sector

	Price increase		Fuel		Output (% change)[3]		
Country	Period	% Change[1]	Type	Cost share %[2]	I	II	III
Malaysia	1984-85	17	Diesel	1.0 - 6.2	6.3	2.1	7.2
Indonesia	1982-85	310	Diesel	0.3 - 8.0	0	5.1	6.2
Ghana	1983-87	214	Diesel	0.3 - 12.0	-19	22.5	2.2
Zimbabwe	1983-84	95	Electricity	>6.0	7.9	-1.7	9.7
Colombia	1985-88	42	Electricity	1.2 - 6.8	n.a.	n.a.	n.a.
Turkey	1987-88	84 and 80	Dis. & Elec.	n.a.	10.6	1.5	9.5

n.a. = missing data.

Note: 1. Price changes refer to changes in real prices (1986 local currency) over the whole period of the reform.

2. Cost shares for Ghana and Colombia are for all petroleum products and energy respectively.

3. Output figures refer to average annual growth rates (percent) of manufacturing output for three different periods: I = 2 years preceding the price reform, II = During the reform, and III = 2 years following the reform. For Indonesia Output I refers to only 1 year preceding the price reform, and for Turkey, Malaysia and Zimbabwe output III refers to 1 year following the price reform. For Ghana, output growth rates are unweighted averages.

For all the countries, growth rates in manufacturing were higher after the reforms (Output Change III) than before the reforms (Output Change I), except for Turkey, where growth rates were high both before and after.

The period of energy price changes coincided with widespread changes in economic policies under the structural adjustment programs being implemented in these countries during this time. To better understand these direct output effects we need to examine the overall economic policy environment in these countries. For example in Ghana, prior to the period of reforms, capacity utilization in the industrial sector was between 10-18 percent. Output prices for most of the commodities were determined by their scarcity, and there were high levels of quota rents. An important part of the adjustment program was the mobilization of foreign resources from bilateral and multilateral aid programs. In addition, widespread reforms involving the introduction of flexible exchange rates, abolition of price controls and general liberalization of the economy were implemented during this period. All these measures improved the availability of essential inputs for the industrial sector. It is most likely that domestic energy price increases in Ghana were absorbed by producers via reductions in profit margins while output increased.

Impacts of Energy Price Increases: The Household Sector

Kerosene and electricity are the two most important commercial fuels[1] used by the household sector. More recently, LPG has also become important in some countries. Changes in the relative prices of these fuels would affect household consumption. It is the welfare effect of the changes in household consumption that are of interest for policy purposes. The two most important parameters determining the effect of an increase in fuel prices on household energy consumption are dependence of the household on these fuels, measured by the fuel budget share, and household flexibility both with respect to substitution between different fuels and between energy, and other consumption goods and services.

The share of household expenditure on commercial energy varies according to the income and geographic location of the household. The case studies confirm an inverse relationship between income levels and energy budget shares, with higher-income households typically having lower energy budget shares than low-income households. Rural households tend to have a lower budget share for commercial energy as compared to urban households. This is expected, given rural access to non-commercial fuels such

[1] In this study we distinguish between commercial and non-commercial fuels. Commercial fuels consist of coal, petroleum products, gas and electricity. Non-commercial fuels include all other types of fuels such as agriculture residues, dung, firewood, etc.

as agriculture waste and firewood. Urban low-income households were observed to have the highest budget shares for commercial energy. In absolute terms, the highest budget shares for kerosene lie between 3.6 and 6 percent. For electricity the relevant range is 1 to 9 percent.

There are few reliable estimates to gauge the flexibility of households with respect to interfuel substitution and substitution between energy and other consumption goods. Where elasticity estimates are available, the elasticity of demand for kerosene is close to -1, i.e., a one percent increase in price leads to close to a one percent fall in consumption. The price elasticity of demand for electricity is relatively low and lies between -0.08 and -0.32. The loss of welfare depends on the elasticity of demand, the expenditure share and the price change; the upper bound on the welfare effect is when the demand elasticity is zero. Table 2 summarizes the welfare effect of domestic energy price changes for the countries analyzed.

Analysis indicates that the welfare effect (expressed as a loss in consumer surplus) due to an increase in domestic kerosene prices is equivalent to 1.3 to 2.23 percent of household income. For electricity price changes, the welfare loss was estimated to be between 2.2 and 3.35 percent of household income. The figures reported in table 2 are for groups of households showing the greatest loss as compared to other households in the country. In all the cases these are low-income households residing in urban areas.

Table 2: Welfare Impacts of Energy Price Increases: The Household Sector

Country	Year	Price[1] (% change)	Fuel	Budget share (%)	Assumed elasticity	Welfare[2] (% change)
Malaysia	1985	33.0	Kerosene	4.0	-0.81	-1.3
Indonesia	1983	50.0	Kerosene	6.0	-1.02	-2.23
Ghana	1983-87	39.0	Kerosene	3.6	0	-1.4
Zimbabwe	1984	38.7	Electricity	5.0	-0.08	-2.2
Colombia	1985-88	35.5	Electricity	9.4	0	-3.35
Turkey	1988	80.0	Electricity	3.01	0	-2.4

Note: 1. Price changes generally refer to changes in real prices (1986 local currency) over the previous year's prices--for Ghana: the average increase over the years. For Columbia, estimates refer to changes in price between 1985 and 1988.

2. Welfare impacts refer to the loss in consumer surplus (CS). Estimates are reported as a percent of income for the households with highest loss. For Turkey, Ghana and Columbia, the estimates of welfare loss can be interpreted as the "worst case" scenario as it is based on the assumption that price elasticity of demand is equal to zero.

Macroeconomic Impacts

Key macroeconomic indicators are influenced by a number of factors. Isolating the effects of energy price changes from the effects of other factors would require an extensive modelling exercise, which is beyond the scope of this study. However, a preliminary analysis of macroeconomic trends is useful.

An increase in domestic energy prices can be expected to shift cost structures in the user sectors and thereby the consumer price level. Depending on the response of nominal wages to an increase in the CPI, an energy price increase may spread throughout the economy leading to a general price increase. The energy sector in these countries is dominated by public enterprises. An increase in energy prices charged by these enterprises, which results in an improvement of operating surplus for these firms, also leads to lower fiscal subsidies to the sector. To the extent lower subsidies result in lower levels of taxation for other inputs, the impact on the price level would be moderated. Another source often used to finance energy subsidies is state borrowing from the central bank. In this case, higher energy prices, which reduce subsidies and fiscal deficits of the public enterprises, would lead to less money creation. Thus, the aggregate effect of raising energy prices on the general price level will depend on both cost-push inflation and lower inflation due to less money creation. The net effect will depend on the structural and policy variables in each case study. Table 3 summarizes key macroeconomic variables.

As table 3 shows, the response of the price level to energy price increases varied across different countries. Most countries show no large increases in the CPI during the period of energy price increases (Price change II) as compared with the preceding two years (Price change I). This can be explained partly by the fact that food prices are the most important element affecting the index. In addition to its direct effect, the impact of energy prices on the CPI thus crucially depends on the sensitivity of the food or agriculture sector to energy prices. However, the importance of energy inputs in agriculture is often negligible (for instance with small-scale peasant farmers). In general, the revenue effects of increases in energy prices were substantial in most of the countries. Combined with the austerity in public expenditures, which was a characteristic of the stabilization programs under implementation at the time in these countries, the mild effect of an energy price increase on the price level is expected.

For countries where an increase in energy prices coincided with high inflation, there is little evidence to suggest that inflation was directly due to an increase in energy prices. In Ghana, one important factor that led to higher inflation was a substantial depreciation in exchange rates under the stabilization program. In two cases, Colombia and Zimbabwe, an increase in the CPI was influenced by crop failures

Table 3: Macroeconomic Indicators and Energy Price Changes

Country	Reform period	Fuel	Price change %[3]	Price level[1] (% change) I	II	III	Revenue impact %[2]	GDP (% change)[4] I	II	III
Malaysia	1984-85	Diesel Kerosene	80.0 69.5	4.9	2.1	1.1	2	6.3	3.3	3.3
Indonesia	1982-85	Diesel Kerosene	21.8 23.0	9.0	9.2	9.6	18	3.5	3.9	5.4
Ghana	1983-87	Diesel Kerosene	4.0 3.0	82.4	99.6	32.3	38	-5.1	4.0	5.5
Zimbabwe	1983-84	Diesel Kerosene	39.7	11.3	13.2	8.1	6	5.7	0.7	7.6
Colombia	1985-88	Diesel Kerosene	36.22	-12.6	13.7	n.a.	4	2.5	4.8	3.9
Turkey	1987-88	Diesel Kerosene	33.3 23.5	45.5	56.6	61.5	20	6.9	2.6	8.2

n.a. = missing data.

Note: 1. Price level figures refer to average annual growth rates (percent) of Consumer Price Index CPI for three different periods: I = 2 years preceding the price reform, II = During the reform, and III = 2 years following the reform.

2. Revenue impacts of the price reform are for the last year of the reform period and reported as a percent of total central government revenues for the corresponding year. Dis. = Diesel, Ker.= Kerosene and Elec. = Electricity.

3. Nominal prices in the year prior to the beginning of the reform (base year) expressed as a percentage of the price in the last year of the reform.

4. Output figures refer to average annual growth rates (percent) of GDP for three different periods: I = 2 years preceding the price reform, II = During the reform, and III = 2 years following the reform.

caused by drought. Another important factor was an increase in wages, which cannot be traced directly to the energy prices increase. Rising wages were the result of government policy either to correct the racially-based wage structure (Zimbabwe) or to obtain relief from erosion of real wages, which occurred due to economic conditions prior to the period of energy price reforms (Turkey). An increase in energy prices could have added to these inflationary conditions. However, there is hardly any evidence in the analysis to support the hypothesis of energy price increases triggering inflation.

In the early 1980s the domestic prices of diesel, kerosene and electricity were subsidized in most of the countries analyzed. Toward the end of the 1980s the domestic price increases, combined with a

general fall in international oil prices, left domestic diesel and kerosene prices above border prices. The only exception was Indonesia, where domestic prices for diesel and kerosene remained below border prices for most of the 1980s. Despite the price increases, domestic prices for electricity remained below the average incremental costs of power system expansion in most of these countries during the period analyzed.

For three countries, growth rates (GDP Change II) were higher during the time of energy price increases as compared to the preceding two years (GDP change I), but not for Malaysia, Turkey and Zimbabwe. For Malaysia, Turkey and Zimbabwe the fall in growth rates was temporary, and during the period that followed the price reforms they quickly saw a recovery in output (GDP change III). As mentioned earlier, this was a period of economic policy reforms in most of these countries and recovery in aggregate output was a result of all these combined policy changes. To the extent that energy price increases led to a fall in subsidies and thereby lower taxes and distortions in prices of other inputs, these complementary changes contributed to the general economic recovery in these countries.

1. ENERGY PRICE INCREASES IN DEVELOPING COUNTRIES

Background

Economic performance in developing countries during the last two decades can be divided into the decade of shocks (1970s) and the decade of adjustment (1980s). External shocks affecting these countries were the commodity boom and the first oil price shock during the early 1970s, a rise in interest rates starting late in 1978 followed by a slowdown in the world economy after 1978, a second oil price hike in 1978-80 and softening of oil and other primary commodity prices during the early 1980s. At the same time natural disasters and domestic policies created an urgent need for internal adjustment programs, which were implemented by country governments initially in collaboration with the IMF and later also with the World Bank.

Production and distribution of commercial energy, particularly electricity, in developing countries has often been reserved for the public sector.[1] Diverse arguments based on efficiency and equity have been used to explain the highly centralized organization of the sector, including the presence of increasing returns in production and distribution, the infrastructural role of the energy sector, and provision of energy to low-income groups in the society, etc. Pricing of energy by the public sector has often been held below average supply costs. Although the need for increasing domestic energy prices was emphasized in adjustment policies[2] undertaken during the 1980s, the actual implementation was relatively slow, particularly for electricity and kerosene.

Average tariff levels (in constant US$) for electricity in developing countries were relatively stable during the period 1979-83. During the next four years (1983-87) average electricity tariffs fell by around 35 percent, although there was no change in cost, thereby reaching a level of roughly half the average incremental costs of power system expansion for these countries.[3] Figure 1.1 shows the development in average electricity tariffs from 1980 to 1988 for developing countries and the OECD. Incremental supply costs for 1987 are also shown in the figure.

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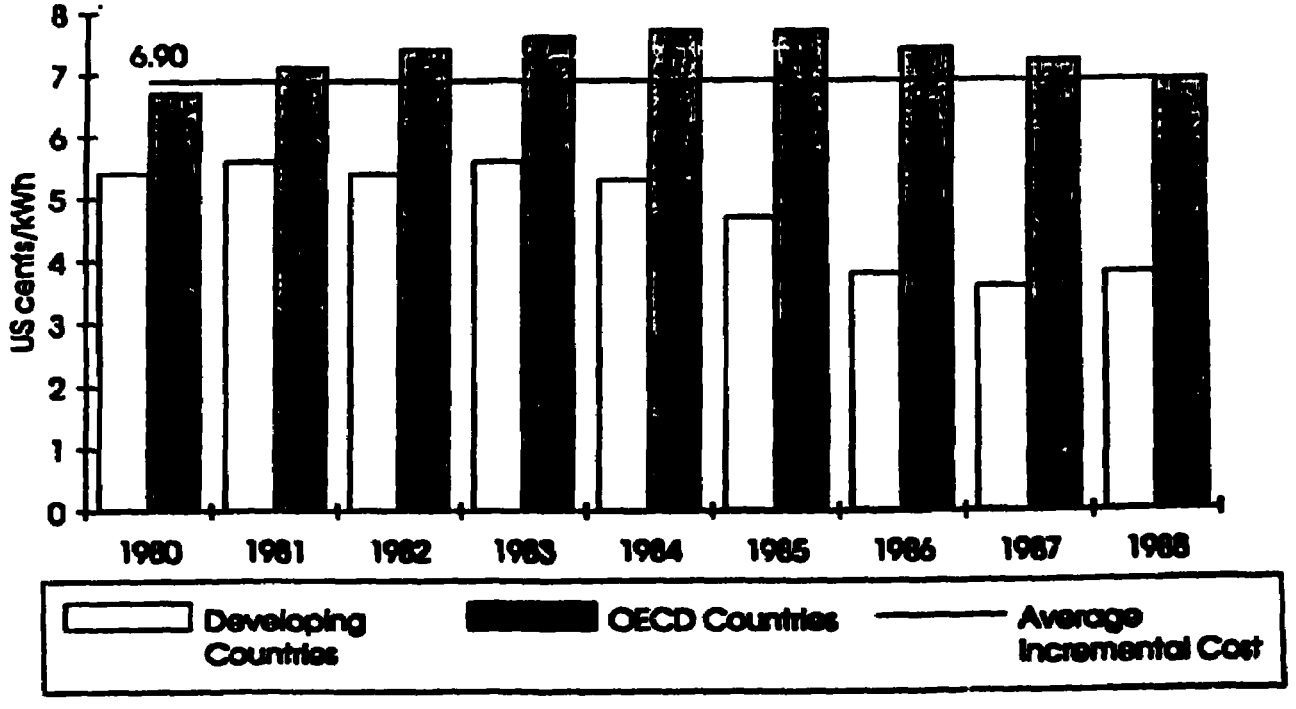
[1] World Bank (1990), Summary Data Sheets of 1987 Power and Commercial Energy Statistics for 100 Developing Countries, Energy Series Paper No. 23, Industry and Energy Department Working Paper, Washington, D.C.

[2] Balassa, B. (1981), Structural Adjustment Policies in Developing Economies, World Bank Staff Working Paper No. 464, The World Bank, Washington, D.C.

[3] See World Bank (1990): Review of Electricity Tariffs in Developing Countries During the 1980s, Energy Series Paper No. 32, Industry and Energy Department, Washington, D.C.

Figure 1.1: Trend in Average Electricity Tariffs of Developing Countries and OECD Countries, 1980-88



Although domestic petroleum product pricing policies varied across products and countries, subsidization was not as widespread as for electricity. Diesel subsidies were used in oil exporting countries. Kerosene subsidies occurred in oil exporting and importing countries. Gasoline, on the contrary, was taxed in a number of countries. In general, the level of subsidies were much higher during the early 1980s than after 1985. Toward the end of the 1980s, most of the oil exporting countries had subsidies on petroleum products. Figure 1.2 shows the average difference (as a percentage of domestic price) between domestic and border prices for kerosene for a selected group of countries.[4]

Two main factors contributed towards the fall in subsidy levels in the latter part of 1980s: a fall in the international oil prices (i.e., a fall in the opportunity costs of petroleum) and administered changes in domestic prices. For most of the countries, the fall in international oil prices during the 1980s led to changes in subsidy levels, although administered price increases designed to bring domestic prices in line with the border prices were also pursued in a few countries.[5]

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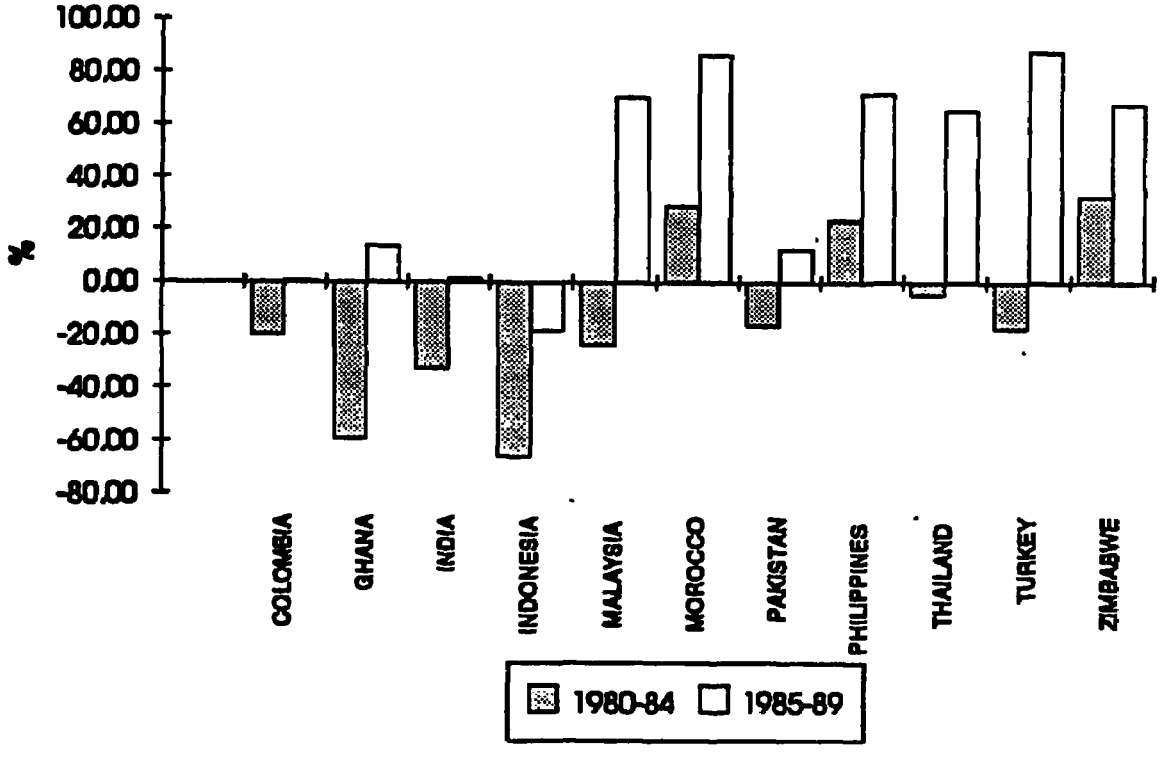
[4] See annex 1.1 for diesel and gasoline price distortions.

[5] See annex 1.2 to 1.4 for developments in petroleum product prices in selected countries.

Figure 1.2: Average Differences between Domestic and Border Prices for Kerosene in Selected Countries, Subsidy (-), Tax (+)



The policy changes that led to an increase in domestic energy prices have been controversial. Proponents of price increases point to the benefits of domestic resource mobilization in the public sector (resulting in reduced fiscal and current account deficits) and improved internal resource allocation. Critics are concerned about negative impacts such as the risk of output losses, inflation, loss of international competitiveness, undesirable effects on the welfare of the poor, and in some cases environmental degradation.

When prices are less than the marginal costs of supply, an increase in price would reduce distortion in the use of energy, a desirable outcome on grounds of efficiency. In practice, equity considerations in energy pricing have also been an important factor for policy makers. An energy price increase can be expected to result in changes in interpersonal distribution of income. Whether the price increase is progressive or regressive in consequence will depend on the structure of demand for energy and the presence of other welfare policies pursued at the time of adjustment. Although there seems to be an agreement concerning the costs of subsidies resulting from low energy prices, there is disagreement relating to the welfare consequences, which makes the policy issue more complex.

Energy Price Changes: Survey and Methodology

Although the emphasis may differ across countries, the following range of objectives have dominated energy pricing policies both in developed and developing countries:

- Economic growth and development
- Equity considerations, such as the provision of cheap energy to lower-income groups
- Macroeconomic stabilization (to generate surplus in the public sector and influence exports and imports to achieve internal and external balance)
- Environmental protection.

The first two objectives have often been used as arguments for maintaining low prices for energy inputs; an implicit economic argument for such practice can be the presence of some positive externalities arising from the provision of energy infrastructure. To what extent this is a valid argument and these policies have or have not contributed to the achievement of these objectives is open to discussion. One of the reasons quoted for low energy prices is that they promote industrial development. Even if we consider industrial development as a goal in itself, low energy prices introduce a bias in favor of energy-intensive industries. Given that energy intensive industries such as metal-smelting, paper, petrochemicals are also capital-intensive, this pattern of development may not be the most appropriate for developing countries with abundant labor resources.

In terms of equity, it is not clear that the poor benefit from energy subsidies. Gasoline subsidies are not necessarily directly beneficial to the poor, as ownership of motor vehicles is relatively low amongst this group.[6] One of the justifications for a subsidy on diesel is that it benefits the poor to the extent it keeps public transportation costs down. However, in this case, it could be more appropriate to directly subsidize public transportation fares rather than diesel given that such distortions have led to increased and often inefficient dieselization of industrial equipment and automobiles in these countries. A subsidy for kerosene may be justified to the extent that it is used for cooking and lighting by poorer households. However, it is again not clear that these subsidies affect their target groups. Kerosene is an income elastic good and the bulk of household kerosene consumption in developing countries is concentrated in urban areas where income levels are higher. Consequently a major portion of the benefits of these subsidies might accrue to

[6] Except to the extent gasoline is used for public transportation. However, it may be mentioned that the most important fuel in public transportation is diesel.

urban middle-income groups.[7] In cases where kerosene subsidies are combined with rationing, the urban poor might also not benefit as rationing schemes often require a permanent place of residence, a requirement that disqualifies a large portion of urban poor living in unauthorized slums.

The last two objectives are of more recent origin. The macroeconomic instability experienced in the early 1980s and the need for austerity in public expenditures in these developing countries brought energy pricing polices under scrutiny. Subsidized prices have often been identified as an important source of deficits in public enterprises in the energy sector. Energy price increases are expected to improve the financial position of these enterprises. However, the extent of these effects also depend on the wage and employment policies of these public enterprises.

The environmentally sensitive nature of energy adds another dimension to pricing policies. The relationship between energy use and environmental degradation has become a subject of debate in recent years. However, how energy pricing policy can be used to attain environmental objectives may be quite ambiguous, and depend on the nature of environmental problems. In the developed countries, the current focus is on the global problem of green-house gases and reduction of carbon dioxide emissions originating from the combustion of fossil fuels. The energy pricing implication of this policy is an upward adjustment in energy prices, especially for fossil fuels. In the developing countries, the current environmental focus is more often the local problem of deforestation and soil erosion. In this context, a substantial increase in domestic prices of commercial energy maybe considered undesirable to the extent it generates substitution of commercial energy by non-commercial energy such as firewood, thereby further accelerating deforestation and soil erosion. Given that deforestation contributes to global warming, the implications of environmental issues for energy pricing policies are quite complex.

The literature analyzing the impacts of energy price changes falls into two groups of studies. One group analyzes international oil price shocks during the 1970s and their economic impacts on both the OECD and developing countries, although the literature on developing countries is limited. The second group analyzes economic adjustment policies in developing countries during the 1980s. Few of them directly address issues related to domestic energy price changes. However, to the extent these studies

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[7] Data for Indonesia indicates that the poorest 20 percent of the population receive less than 10 percent of the kerosene subsidies.

address the role of public sector pricing in adjustment policies, their conclusions are also relevant for the analysis of energy price changes.[8]

Methodologies of analysis used in these studies fall into three subgroups. The first subgroup is based on traditional demand-oriented macroeconometric models[9] involving structural systems comprising behavioral equations and identities to determine aggregate output and price level through interaction of aggregate demand and supply. While differing in the degree of disaggregation of demand and supply and the extent of industrial and market detail and functional specifications of behavioral relationships, the main focus is on analyzing the impacts on GNP of sudden increases in international oil prices. A major limitation of these studies is the treatment of the supply side effects of the energy price changes. The second subgroup consists of energy-economy models belonging to Computable General Equilibrium (CGE) models based essentially on general equilibrium theory and neoclassical theory of economic growth.[10] The emphasis in CGE studies is to simulate the effects on relative prices, resource allocation and welfare consequences of energy policy changes. Lastly, there are some studies that analyze the energy price increase on a sectoral or industry basis within a partial equilibrium framework.

A Framework

Economic impacts of domestic energy price increases can be categorized into two groups: (1) direct partial impacts of price increases on producers and consumers, and (2) overall macroeconomic impacts on price level, government revenues and output. To analyze both the micro and macro impacts and draw policy conclusions, it is important that the framework be sufficiently disaggregated to account for differences in the demand structures of industrial and household consumers of energy. It should also be based on a consistent economywide framework, although not necessarily an economywide model, to allow for an analysis of macro impacts.

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[8] Amaranand, P. and Grais, W. (1984): Macroeconomic and Distributional Implications of Sectoral Policy Interventions. An Application to Thailand. World Bank Staff Working Papers No. 627, Washington, D.C.; Ghouri, N. and S. Lahiri. (1984): Short-run Energy Economy Interactions in Egypt, World Development, Vol . 12, pp. 799-820; Panda, M. and H. Sarkar, (1990): Resource Mobilization through Administered Prices in an Indian CGE, in Taylor, L. ed. (1990) Socially Relevant Policy Analysis, Massachusetts, The MIT Press: World Bank (1983) Indonesia Selected issues of Energy Pricing, Report No. 4285-IND, Washington, D.C.

[9] Hickman B.G., and others (1987): Macroeconomic Impacts of Energy Shocks, Amsterdam, North-Holland.

[10] See Bergman, L. (1988): Energy Policy Modelling; A Survey of General Equilibrium Approaches, Journal of Policy Modelling, Vol. 10, pp. 377-400.

Accordingly, each country analysis in this report is organized as follows:

- Outline of the general economic environment of the country prior to and during the energy price policy reform.
- Analysis of the direct partial-impacts on costs, output and energy consumption in the industrial sector and consumption and welfare of household consumers.
- Analysis of overall macroeconomic impacts on aggregate price level, government revenues, subsidy levels and output.

Such an analysis for each country requires detailed information about the structure of demand for different categories of energy consumers, as well as economic policies and structural constraints. Because this information was not always available for all the countries analyzed, the degree of detail in the case studies will vary.

Energy Demand in the Industrial Sector

The industrial sector consists of a large number of firms with different production structures producing a variety of goods. To analyze the impact of energy price changes we need to operate at a meaningful level of disaggregation. An additional complexity in establishing a cause and effect relationship arises due to the fact that energy policy is only one element of the economic environment facing a firm. The impact of energy price changes will depend on how the other elements, for example industrial policy and trade policies, are adjusted.

There are various analytical frameworks to analyze the demand for energy by commercial users, such as the industrial sector. Assuming perfect competition in the goods and factor markets and cost minimization behavior on the part of the firm, which is subject to constant returns to scale in production, demand for energy by an industrial firm can be considered as a two-stage optimization process. Realizing that energy is a composite good comprised of various fuels, the firm in the first stage chooses the fuel-mix that minimizes the cost of providing a unit of aggregate energy input. In the second stage the firm chooses the factor-mix, i.e., labor, capital and energy (assuming three inputs) to minimize the cost of producing a unit of output. Since, in the short-run, the capital stock is given, the decision at this stage is to determine the mix of energy and labor. In the medium- and long-run the firm could adjust its stock of capital in energy-using equipment and thereby have more flexibility in adjusting its energy use. Thus, the impact of

energy price changes on the firm will depend on both the interfuel substitution possibilities and the possibilities of substitution between energy and other primary factors of production.[11]

Energy Demand of the Household Sector

Households use energy for lighting, cooking, heating, cooling, refrigeration, washing, etc. Demand is dependent on the stock of energy-using appliances in of the household, their preferences for the above services and other non-energy goods, and income. In the short-run, it is reasonable to assume that the stock of appliances is fixed and thus the impact of an increase in energy price on the household demand for energy is determined by a change in the rate of use of the existing stock of appliances (depending on preferences between energy and non-energy goods, and income). In the long-run, households can adjust their stock of appliances. The main implications of this inflexibility in the adjustment of appliance stocks and rigidity of preferences for household energy demand is that in the short-run the impact of an energy price increase on household demand would be lower as compared to the long-term, when both new appliances can be acquired and preferences may change.[12] This implies that the welfare cost of a given price increase would be reduced in the long-run, when households have a chance to fully adjust in response to the change in prices.

Macroeconomic Impacts

An increase in domestic energy prices can be expected to shift cost structures in the user sectors and thereby the consumer price level. Depending on the response of nominal wages to an increase in consumer price level, an energy price increase may spread throughout the economy and increase the general price level.[13] An increase in energy prices charged by public enterprises, provided it leads to an increase in the operating surpluses of these firms, should also result in lower fiscal subsidies. To the extent lower subsidies result in lower levels of taxation for other inputs, the inflationary impact of an energy price increase would be moderated. Energy subsidies are often financed through state borrowing from the central bank. In this case, higher energy prices that reduce subsidies and fiscal deficits of the public enterprises

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[11] For a general formulation of the response of the firm to an energy price increase, see annex 1.5.

[12] For a general formulation of the households' response to an energy price increase see annex 1.6.

[13] For a stylized framework addressing macroeconomic impacts of domestic energy price changes see World Bank (1983): Indonesia, Selected Issues of Energy Pricing Policies, Vol. III, Report No. 4285-IND, pp. 49-52, Washington, D.C.

would lead to less money creation. Thus, the aggregate impact of raising energy prices on general price level will depend on both the effects on cost-push inflation and lower inflation due to less money creation. The net effect remains ambiguous[14] and will depend on the structural and policy variables in each case study.

The impact of an increase in domestic energy prices on government revenues will depend on the effect of the price increase on the operating surplus of the energy sector enterprises and the extent to which the government succeeds in collecting this surplus. The former depends on the wage policies of these enterprises, the effectiveness of the government budgetary control, etc., whereas the latter depends on the transfer mechanisms (tax policy, royalty agreements, etc.) applicable to these enterprises. At one extreme, if an increase in revenues from price changes is completely offset by higher wage bills, one might not observe any improvement in the operating surpluses and, most likely, no improvement in government revenues. At the other extreme, if government adopts restrictive wage policies and implements an effective budgetary control of these enterprises it may be able to obtain a large portion of the increase in revenues generated by price increases. To calculate the exact revenue effects of energy price increases requires a detailed analysis of the financial statements of the energy sector enterprises, which is beyond the scope of this study. However, the revenue impact for a given price reform can be estimated as the difference between the estimated net revenues in that year and the hypothetical level of net revenues in the same period had the reforms not been implemented.[15] For petroleum products, net revenues are defined as the difference between gross sales minus the domestic production costs (border prices) for net oil-exporting (importing) countries. For the electricity sector, in the absence of reliable estimates of domestic production costs, only changes in gross revenues are reported. To give an idea of the dimension of these revenue effects, the same are also compared with total government revenues for the same year.

Policy Implementation: The Time Path

Policymakers may contemplate alternative time paths for implementation of policy changes. In the context of energy price policies, some of the alternatives are a one-shot adjustment followed by prices which could be either constant or fluctuate in line with, for example, border prices. A gradual increase spread over a period of time is another alternative.

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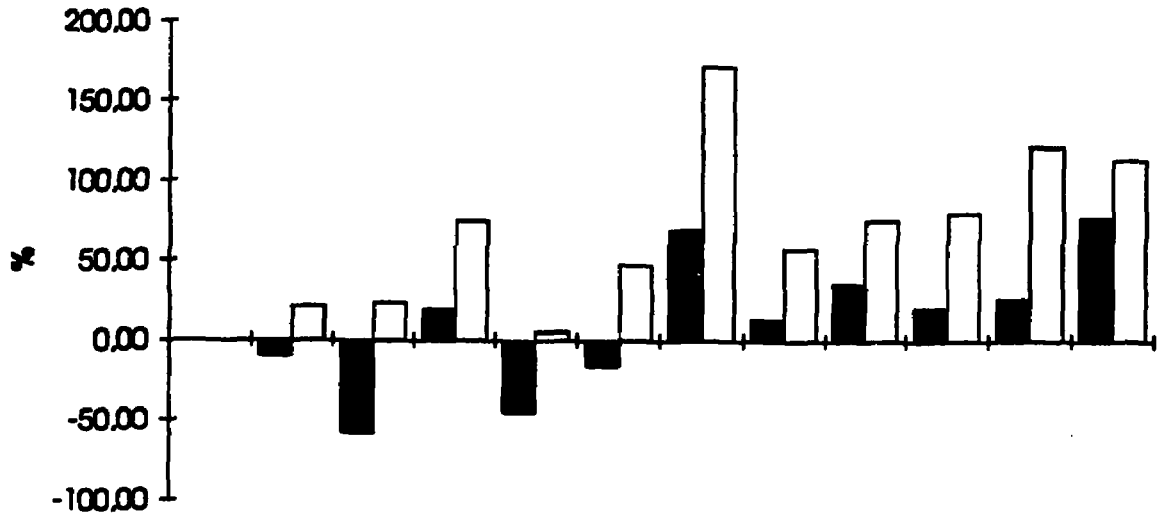
[14] See Taylor, L. (1991): Varieties of Stabilization Experience, Clarendon, Oxford.

[15] See annex 1.7 for details.

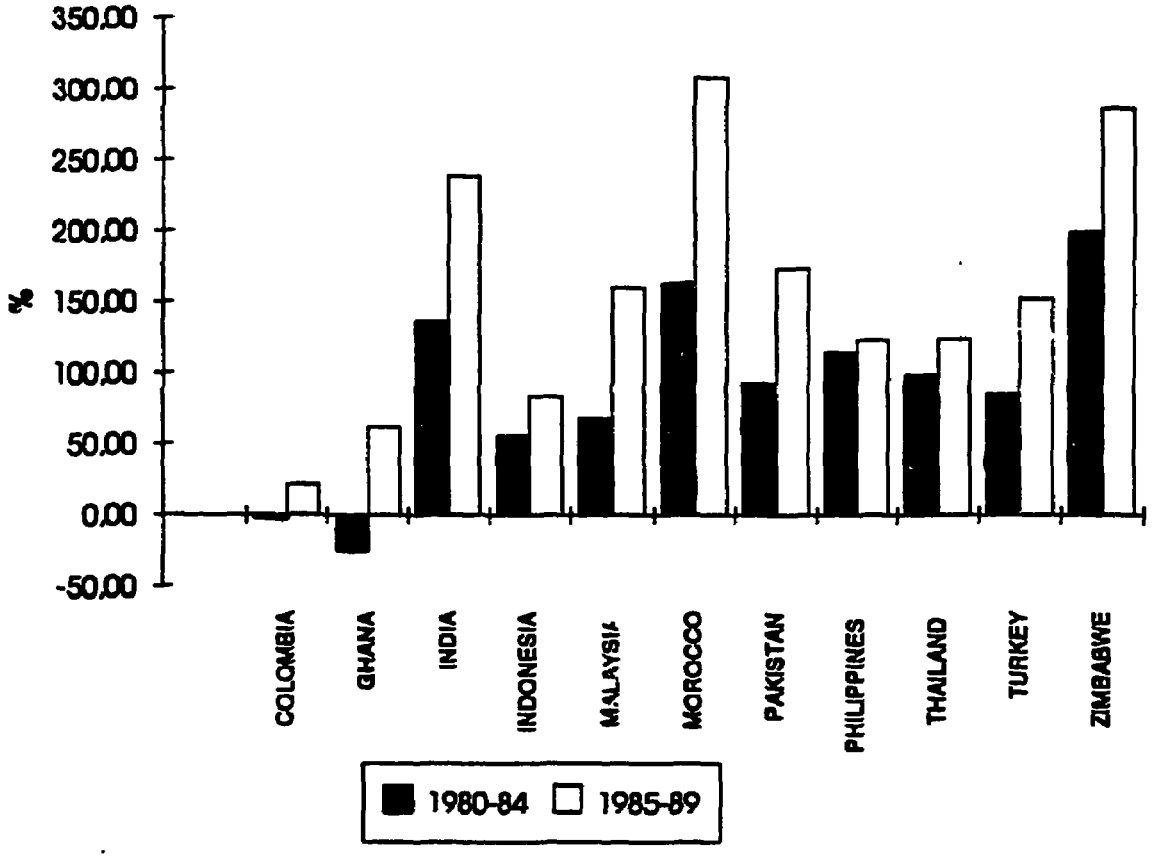
The policy of abrupt adjustment followed by either a period of constant or fluctuating prices has important economic consequences. Given the derived demand nature of the energy inputs and partial adjustment in stock of energy-using appliances, abrupt changes in energy prices can lead to higher short-run adjustment costs for users. Equally important is the decision concerning policies to be followed after such an initial adjustment. Governments could follow a "crawling-peg" and undertake periodic adjustments or it could continually adjust prices in line with the border prices. In the latter case, there are again two alternatives: energy prices remain administered or the government deregulates and resorts to market-determined energy prices. Adjustment costs imposed by such policies will also depend on the uncertainty in international oil prices. In the case of wide fluctuations in international prices, policies where domestic prices adjust in line with international prices could limit government's ability to shelter the domestic market from the international market, thereby increasing uncertainty for investment decisions. Similarly, consumers may delay shifting out of their energy inefficient capital stock. A price policy that involves gradual change may minimize adjustment costs or it may also delay adjustment towards energy efficient technology. There is also the risk of speculative hoarding, especially of fossil fuels, by the private sector. In the present context, however, energy price increases in developing countries during the last decade have been primarily motivated by urgent macroeconomic stabilization needs in these countries in which case one-shot adjustment is perhaps the only alternative.

Annex 1.1

Average Differences Between Domestic and Border Prices for Diesel in Selected Countries, Subsidy (-), Tax (+)



Average Differences Between Domestic and Border Prices for Gasoline in Selected Countries, Subsidy (-), Tax (+)



Annex 1.2

Domestic Nominal Kerosene Prices Including Taxes to End-users
(local currency per liter)

Country	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Colombia	9.04	11.67	14.51	17.79	17.79	23.40	28.87	35.62	45.64	58.47
Ghana	0.92	1.32	1.20	2.90	7.70	11.95	19.50	24.20	37.40	41.80
India	1.54	1.64	1.81	1.80	1.86	2.03	2.24	2.26	2.24	2.23
Indonesia	37.98	37.98	60.11	99.87	134.05	165.22	165.22	164.81	164.45	166.72
Malaysia	0.35	0.46	0.46	0.46	0.62	0.66	0.54	0.53	0.68	0.67
Morocco	1.85	1.72	2.11	2.42	2.30	3.12	2.26	1.64	3.10	3.11
Pakistan	2.51	2.75	2.74	2.73	2.45	3.29	3.01	3.01	2.98	3.00
Philippines	2.40	3.13	3.12	3.44	5.04	5.78	4.81	5.28	3.72	4.98
Thailand	5.68	6.12	6.14	6.15	4.98	6.20	6.10	6.13	4.97	6.14
Turkey	0.00	36.77	57.75	69.03	98.98	136.04	0.00	194.20	579.59	1209.12
Zimbabwe	0.29	0.30	0.31	0.35	0.36	0.36	0.35	0.59	0.59	0.62

Domestic Real Kerosene Prices Including Taxes to End-users
(local 1986 constant currency per liter)

Country	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Colombia	32.63	33.64	33.74	33.76	27.83	29.66	28.87	28.25	36.42	46.25
Ghana	10.07	8.3	5.96	6.61	13.18	16.86	19.5	17.22	19.73	16.9
India	2.41	2.35	2.42	2.24	2.16	2.20	2.24	2.08	2.08	2.07
Indonesia	70.01	57.59	83.30	124.94	148.83	169.44	165.22	152.75	147.44	154.09
Malaysia	0.39	0.50	0.49	0.47	0.60	0.63	0.54	0.54	0.65	0.64
Morocco	3.03	2.58	2.91	3.12	2.74	3.42	2.26	1.53	2.97	2.99
Pakistan	3.87	3.87	3.52	3.27	2.73	3.42	3.01	2.89	2.79	2.75
Philippines	6.36	7.30	6.64	6.65	7.45	6.36	4.81	5.07	3.43	4.52
Thailand	7.18	7.00	6.62	6.40	5.10	6.32	6.10	5.93	4.72	5.78
Turkey	0.00	180.07	209.12	194.11	199.91	187.52	0.00	143.96	380.30	730.49
Zimbabwe	0.55	0.50	0.46	0.44	0.40	0.39	0.35	0.53	0.53	0.58

Border Prices for Kerosene
(local currency per liter)

Country	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Colombia	13.27	14.80	17.06	18.97	24.11	31.30	27.08	33.78	40.78	56.50
Ghana*	5.89	5.75	5.6	5.04	8.89	12.47	13.33	23.76	30.27	41.76
India	1.94	2.66	2.90	2.97	2.61	2.81	1.82	1.80	2.23	2.59
Indonesia	160.51	195.56	195.53	261.43	233.29	240.71	138.99	211.17	223.18	246.20
Malaysia	0.56	0.71	0.69	0.67	0.53	0.54	0.28	0.32	0.35	0.38
Morocco	0.96	1.59	1.85	2.09	2.03	2.29	1.32	1.16	1.26	1.32
Pakistan	2.42	3.04	3.64	3.85	3.23	3.45	2.33	2.39	2.70	2.97
Philippines	1.92	2.45	2.52	3.20	3.80	4.03	2.21	2.64	2.79	3.02
Thailand	5.24	6.75	6.80	6.61	5.38	5.89	2.85	3.30	3.35	3.57
Turkey	20.09	36.56	53.30	71.56	92.70	129.17	10.08	132.89	248.56	367.30
Zimbabwe	0.17	0.22	0.24	0.31	0.31	0.39	0.26	0.24	0.30	0.36

*Shadow exchange rate for 1980 through 1983 assumed to be 1US$=20 cedis, official exchange rates thereafter.

Annex 1.3

Domestic Nominal Diesel Prices Including Taxes to End-users
(local currency per liter)

Country	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Colombia	9.04	11.67	14.51	17.79	19.93	28.45	35.53	44.36	49.41	55.03
Ghana	0.47	1.06	1.0	2.81	8.34	11.62	20.03	28.24	36.96	42.49
India	2.28	2.67	3.02	3.22	3.27	3.46	3.48	3.51	3.51	3.48
Indonesia	44.58	52.84	85.87	144.25	220.29	242.32	200.26	200.45	200.99	200.07
Malaysia	0.38	0.46	0.46	0.47	0.58	0.59	0.46	0.46	0.53	0.57
Morocco	1.85	2.56	3.27	2.74	2.63	3.45	3.45	3.45	3.44	3.45
Pakistan	2.82	3.06	3.45	4.01	3.60	4.26	3.83	3.84	3.86	3.84
Philippines	2.40	3.11	3.12	3.44	5.23	5.73	4.76	5.23	3.72	4.98
Thailand	6.54	7.40	7.41	7.00	5.65	6.69	6.31	6.33	6.10	6.08
Turkey	36.89	35.80	55.99	71.93	100.17	129.85	188.08	272.42	565.22	1184.69
Zimbabwe	0.34	0.34	0.35	0.50	0.51	0.53	0.54	0.63	0.63	0.63

Domestic Real Diesel Prices Including Taxes to End-users
(local 1986 constant currency per liter)

Country	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Colombia	32.63	33.64	33.74	33.76	31.17	36.06	35.53	35.18	39.43	43.53
Ghana	5.15	6.66	4.96	6.40	14.27	16.40	20.03	20.1	19.5	17.8
India	3.57	3.83	4.04	4.01	3.79	3.76	3.48	3.23	3.26	3.23
Indonesia	82.19	80.12	119.01	180.47	244.58	248.51	200.26	185.78	180.20	184.91
Malaysia	0.43	0.50	0.49	0.48	0.56	0.56	0.46	0.47	0.51	0.55
Morocco	3.03	3.83	4.51	3.52	3.13	3.78	3.45	3.21	3.31	3.32
Pakistan	4.36	4.31	4.43	4.81	4.01	4.43	3.83	3.69	3.61	3.52
Philippines	6.36	7.25	6.64	6.65	7.73	6.30	4.76	5.01	3.43	4.52
Thailand	8.28	8.46	7.99	7.28	5.78	63.82	6.31	6.12	5.79	5.72
Turkey	311.27	175.29	202.80	202.27	202.32	179.00	188.08	201.95	370.87	715.74
Zimbabwe	0.65	0.58	0.52	0.63	0.57	0.58	0.54	0.56	0.57	0.59

Border Prices for Diesel
(local currency per liter)

Country	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Colombia	11.27	13.44	15.63	17.43	23.10	30.13	24.90	31.99	37.87	54.62
Ghana*	5.09	5.24	5.16	4.7	8.56	12.05	12.37	22.61	28.34	40.51
India	1.84	2.44	2.69	2.74	2.49	2.61	1.58	1.76	2.09	2.28
Indonesia	149.69	178.32	184.10	245.20	203.22	217.09	133.69	205.69	228.44	251.45
Malaysia	0.52	0.65	0.65	0.63	0.46	0.49	0.27	0.32	0.36	0.38
Morocco	0.91	1.46	1.71	1.93	1.93	2.12	1.14	1.13	1.19	1.16
Pakistan	2.29	2.79	3.37	3.56	3.08	3.20	2.02	2.33	2.54	2.62
Philippines	1.79	2.23	2.38	3.00	3.31	3.64	2.12	2.57	2.86	3.09
Thailand	4.89	6.16	6.40	6.20	4.68	5.31	2.74	3.22	3.43	3.65
Turkey	19.18	33.80	49.68	66.63	88.96	121.09	97.48	130.35	236.63	329.86
Zimbabwe	0.16	0.21	0.23	0.29	0.29	0.36	0.23	0.24	0.28	32

*Shadow exchange rate for 1980 through 1983 assumed to be 1US$=20 cedis, official exchange rates thereafter.

Annex 1.4

Domestic Nominal Gasoline Prices Including Taxes to End-users (local currency per liter)

Country	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Colombia	11.18	13.84	16.86	20.11	20.16	32.13	38.60	46.37	63.99	67.64
Ghana	1.66	2.85	2.49	4.84	12.32	19.43	30.8	39.6	50.59	59.5
India	5.28	5.68	6.24	6.29	6.42	7.29	7.48	7.48	8.53	8.56
Indonesia	219.63	219.63	360.63	399.47	400.53	440.58	440.58	445.44	383.73	385.84
Malaysia	0.90	1.08	1.08	1.03	1.06	1.14	0.95	0.92	1.16	1.14
Morocco	3.65	3.96	3.22	4.78	5.47	6.05	6.05	6.05	6.05	6.05
Pakistan	5.20	5.65	5.97	6.50	7.03	6.92	7.61	7.71	8.61	8.59
Philippines	4.49	5.26	5.26	5.47	8.27	8.90	6.92	7.50	5.81	7.05
Thailand	9.78	11.89	13.42	12.60	11.68	11.68	8.90	8.93	8.43	8.45
Turkey	46.76	56.62	92.15	105.57	188.43	193.24	266.24	366.82	780.77	1203.01
Zimbabwe	0.48	0.58	0.69	0.95	1.00	1.03	1.16	1.16	1.16	1.16

Domestic Real Gasoline Prices Including Taxes to End-users (local 1986 constant currency per liter)

Country	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Colombia	40.34	39.89	39.21	38.15	31.53	40.71	38.60	36.77	51.07	53.50
Ghana	18.18	17.92	12.36	11.03	21.09	27.42	30.8	28.19	26.69	24.06
India	8.28	8.14	8.34	7.82	7.44	7.91	7.48	6.88	7.93	7.94
Indonesia	404.88	333.03	499.83	499.76	444.69	451.84	440.58	412.85	344.02	356.60
Malaysia	1.01	1.17	1.15	1.05	1.02	1.08	0.95	0.94	1.11	1.10
Morocco	5.98	5.93	4.45	6.16	6.52	6.63	6.05	5.62	5.81	5.82
Pakistan	8.03	7.97	7.68	7.78	7.83	7.20	7.61	7.42	8.06	7.87
Philippines	11.88	12.27	11.18	10.58	12.22	9.79	6.92	7.20	5.35	6.41
Thailand	12.37	13.61	14.47	13.11	11.95	11.91	8.90	8.63	8.00	7.95
Turkey	394.60	277.26	333.78	296.89	380.57	266.37	266.24	271.93	512.30	726.80
Zimbabwe	0.90	0.98	1.01	1.20	1.13	1.12	1.16	1.04	1.05	1.08

Border Prices for Gasoline
(local currency per liter)

Country	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Colombia	12.00	14.57	17.13	18.33	22.56	31.41	26.13	36.52	45.25	76.29
Ghana*	5.31	5.67	5.6	4.87	8.32	12.47	12.83	25.51	33.21	55.57
India	2.00	2.52	2.68	2.76	2.79	2.97	1.70	1.90	2.49	3.18
Indonesia	158.81	186.82	184.92	244.38	242.76	250.80	169.35	216.46	247.04	314.08
Malaysia	0.55	0.68	0.65	0.62	0.55	0.56	0.34	0.33	0.38	0.48
Morocco	0.99	1.51	1.71	1.95	2.16	2.42	1.23	1.22	1.41	1.62
Pakistan	2.50	2.88	3.35	3.59	3.45	3.64	2.18	2.51	3.01	3.66
Philippines	1.90	2.34	2.39	2.99	3.95	4.20	2.69	2.71	3.09	3.86
Thailand	5.19	6.45	6.43	6.18	5.59	6.13	3.47	3.39	3.71	4.56
Turkey	20.62	34.60	49.14	66.62	97.74	135.04	102.67	138.01	243.12	440.43
Zimbabwe	0.17	0.21	0.23	0.29	0.32	0.41	0.24	0.26	0.29	0.34

Note: *Shadow exchange rate for 1980 through 1983 assumed to be 1US$=20 cedis, official exchange rates thereafter.
Source: "International Energy Annual" (various issues). Information Administration, Department of Energy, Washington, D.C. Domestic Petroleum Product Prices, Economic Advisory Unit, Energy Department, The World Bank, July 1984. Ghana: Ministry of Mines and Energy, Energy Statistics Division.

Annex 1.5 Input Price Increase and Input Demand

Defining the production function for x as

$$x = f(z_1, z_2)$$

where z_i are the factor inputs employed in production of x. Assuming constant returns to scale in production of good x, effect on demand for an input z_i of a unit change in input price w_j can be represented by the following relation

$$\frac{\partial \log z_i}{\partial \log w_j} = \frac{\partial \log x}{\partial \log w_j} + \frac{\partial \log h^i (w_1/w_2)}{\partial \log w_j}$$

The first term on the R.H.S. is the output effect which occurs if factor proportions were held constant and output changed in response to a changed output price resulting from a change in input price. The second term on the R.H.S. is the substitution effect (holding output constant), which occurs due to a change in factor proportions in response to an increase in factor price.

For empirical purposes, it is often convenient to express the above equation in terms of price elasticity of demand for output, substitution elasticity and input cost shares. For a two-input production function, the above relation can be expressed as

$$\epsilon_{11} = v_1 \epsilon_{xp} - (1-v_1) s_{12}$$

where ϵ_{11} is the own price elasticity of demand for input z_1, v_1 is the cost share of z_1, ϵ_{xp} is the price elasticity of demand for output and

$$S_{12} = \frac{\partial \log(z_1/z_2)}{\partial \log(w_1/w_2)} = - \frac{\partial \log(z_1/z_2)}{\partial \log(f_1/f_2)}$$

is the direct elasticity of substitution which measures the proportional change in z_1/z_2 associated with a change in relative marginal products of f_1/f_2, which are in the next instance equal to relative prices w_1/w_2.

For a general case, own and cross price elasticities of demand, other input prices holding constant and output price adjusting can be written as:

$$\epsilon_{ii} = v_1(\epsilon_{xp} + \sigma_{ii})$$

$$\epsilon_{ij} = v_j (\epsilon_{xp} - \sigma_{ij})$$

where by definition

σ_{ij} is the allen elasticity of substitution

The above decomposition of price elasticity of demand for input into the output effect and a substitution effect shows that the effect on demand for an input of a unit increase in its price is dependent on three important parameters. These are the importance of the input in production, as represented by its cost share, the price elasticity of demand for the output and lastly the ease with which the input whose price increases can be substituted by the other inputs; the ease of substitution being measured by the output constant elasticities of substitution.

Annex 1.6 Energy Price Increase, Household Demand and Welfare

Define an individual demand function for good x as:

$x = f(p_x, p_1, p_2, \ldots, y)$

where p_x is the price of good x and p_i represents the price of other goods and y represents the income or the budget level of the individual consumer.

Effect on demand for x of a unit increase in price of x can be represented by the following relation also referred to as the Slutsky equation:

$$\frac{\partial x}{\partial p_x} = \left.\frac{\partial x}{\partial p_x}\right|_{u=u_0} - x\,\frac{\partial x}{\partial y}$$

where the first term on the R.H.S. is the substitution effect, assuming that consumer is compensated such that the utility is held at the same level as prior to the price change, and the second term is the income effect.

For empirical purposes, it is often convenient to express the above equation in terms of price and income elasticities[16] and expenditure shares. Thus multiplying both sides of the above equation by p/x and the last term by y/y and rearranging terms we can express the above as follows:

$$\eta_{xp} = \eta^{s}_{xp} - v_x\,\eta_{xy}$$

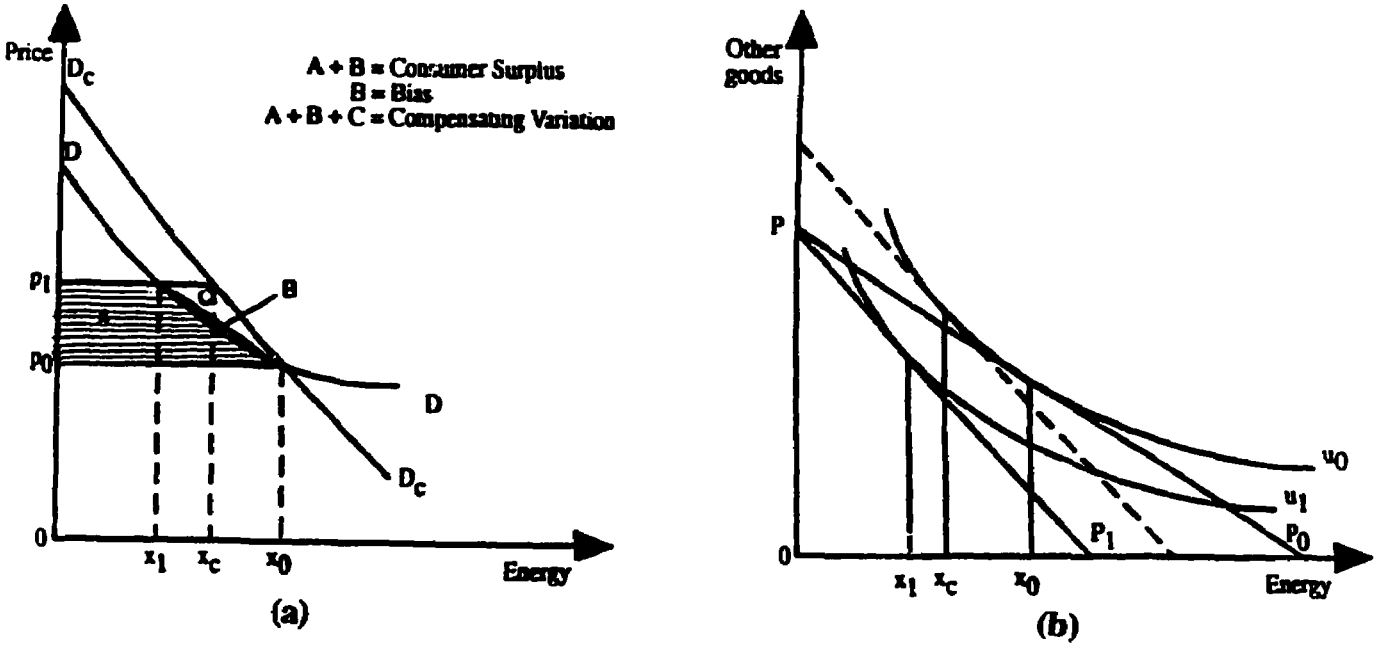
where η_{xp} is the own price elasticity, η^{s}_{xp} is the substitution elasticity w.r.t. other goods, $v_x = x/y$ is the share of consumers income spent on good x and n_{xy} is the income elasticity for good x.

Thus total impact of a price change on demand will depend on the sign of both price and income elasticities. For a normal good, both income and substitution effects work in the same direction: opposite to that of the price change. For an inferior good, income and substitution effects work in the opposite

[16] Elasticity of a dependant variable with respect to the independent variables is defined as the percentage change in the dependant variable due to a 1 percent change in the independent variable assuming all other independent variables remain unchanged. Thus own price elasticity measures the percentage change in demand for x in response to a 1 percent change in price of good x; all other prices and income constant. Elasticities are not necessarily constant and since empirical estimates are often based on observations involving small price changes, these elasticities are formally valid for analyzing small price changes.

direction, although the substitution effect will dominate the income effect such that price and quantity demanded will still move in the opposite direction.

Price Change and Welfare



Panel a. illustrates the change in welfare due to the change in prices. Let DD and D_cD_c be the respective ordinary demand curve and compensated demand curve[17] for good x. These curves are derived from the consumer's utility maximization problem illustrated in panel b. At the initial price p_0 the consumer buys x_0 and has the utility level u_0 . Let p_1 be the new price and the consumer buys x_1 and has a lower utility level u_1. In case the consumer income levels are adjusted to keep the consumer at the initial utility level U_0, the consumer buys x_c. The monetary equivalent of the change in the utility levels of the consumer due to change in prices can be expressed by three different measures; namely the compensating variation,[18] the equivalent variation[19] and the change in consumer surplus. Differences in these measures are mainly due

[17] Compensated demand curve which is a locus of points which relates prices and quantities assuming that income levels are always adjusted to keep the consumer on the initial utility level u_0.

[18] Compensating Variation (CV): Given the state of the world S_1, the CV is the compensating change in the budget which is necessary for enabling the consumer to achieve the initial utility level u_0 from the actual new level u_1.

[19] Equivalent Variation (EV): Given the state of the world S_0, the EV is the compensating change in the budget which would move the consumer from the initial utility level u_0 to the actual changed level u_1.

to the way in which the income effect of a change in price is measured. In case the income effect is small, either because the share of income used on the good x is small and/or that the income elasticity of good x is low, the three measures would be approximately identical. In general, the value of a change in consumer surplus would always lie between the compensating variation and the equivalent variation associated with a given price change. In this report, welfare effects of price increases are calculated in terms of changes in consumer surplus.

In panel a, the shaded area "A" approximates the change in consumer surplus due a change in price and the value is defined by the integral

$$\Delta CS = \int_{P_0}^{P_1} D(p)dp$$

Calculation of the change in consumer surplus in the above manner requires information concerning the functional form of the demand function. However, most often we only have information about the initial and final prices and quantities or price elasticities. Given this limited information, if we assume that the demand function is linear within the range x_1 and x_0, the change in consumer surplus can be approximated by the relation

$$\Delta CS = x_1 (p_1 - p_0) + 1/2 (x_0 - x_1)(p_1 - p_0)$$

The linearity assumption, for example, in panel a, would lead to an upward bias equal to area "B" in estimating the change in consumer surplus. However, keeping in mind the uncertainty related to the true functional form of the demand function, this bias may not be serious.

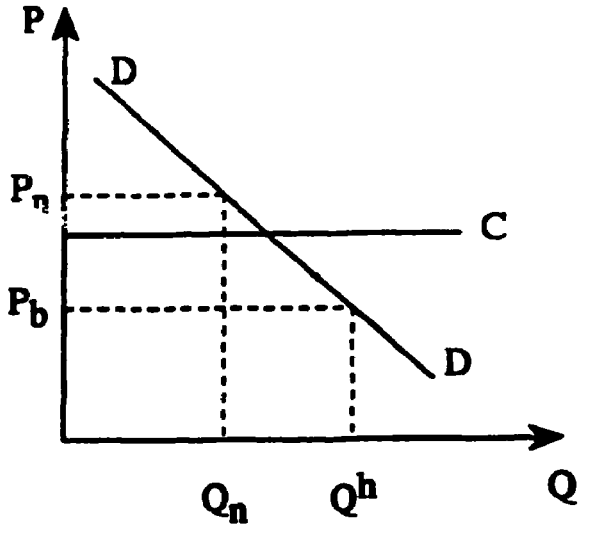
Given a starting point x_0, p_0, the welfare loss ΔCS is linear in the price elasticity and quadratic in the new price:

$$\Delta CS = x_0 (p_1 - p_0) \left(1 + .5 \times \varepsilon \times \frac{p_1 - p_0}{p_0}\right).$$

The way in which the welfare loss depends on the price elasticity can be illustrated, seeing $\varepsilon = 0$ and $\varepsilon = -1$ as providing a high and a low case for the welfare loss: At a price elasticity of zero, the welfare loss will be proportional to the price change. At a price elasticity of one, the welfare loss will be reduced by 5 percent for a 10 percent price change, and by 50 percent for a 100 percent price change.

Annex 1.7 Revenue Effect

Net revenue effect of a given price reform is calculated as follows:



Net-revenue effect R for the reform is given by:

$$R = (P_n - C)Q_n - (P_b - C)Q^h$$

where

$$Q^h = Q_n(1+\eta_p(P_b - P_n)/P_n)$$

P and Q refers to the prices and quantities respectively. Subscripts b refers to the base year, i.e., the year prior to the starting year for the reform and subscript n refers to the ending year, i.e., the year when the price reform was completed. Quantity Q^h is the hypothetical quantity traded assuming no reform in prices was implemented. C is the domestic supply cost[20] and η_p is the price elasticity of demand. The net-revenue effect of the price reform is equal to the difference between two terms: the first term on the RHS represents net-revenues in period n given the price-increases implemented under the policy reform and the second term represents the hypothetical net revenues in the same period assuming no price reform was implemented.

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[20] For oil exporting countries a cost estimate of US$ 20 per barrel of refined composite petroleum products is used for estimating the net revenue effect. For oil importing countries, cost refers to the border price for relevant petroleum product. Cost estimates are converted to local currency using current official exchange rates.

2. MALAYSIA: DIESEL AND KEROSENE PRICE INCREASES 1984-85

Introduction

Malaysia consists of the mainland peninsula and the states of Sarawak and Sabah on the island of Borneo. The country, situated in South-East Asia, has an equatorial climate and covers a total area of 329,293 square kilometers. It has a total population of 17.9 million and GNP per capita of US$ 2320, placing it amongst the middle-income countries in the region.[21]

The Economy

Malaysia is one of the fastest growing economies with annual growth rates of per-capita income during the last decade averaging over 5.2 percent per year. During the 1960s it was a traditional primary-commodity supplier of rubber, tin, timber and palm oil and since the mid-1970s it has developed into a diversified, net oil-exporting country. The average annual growth rate of GDP was 5 percent during the 1960s, when rubber and tin sectors contributed 40 percent of the GDP, accounting for 80 percent of the export earnings and absorbing 35 percent of the work force. Ever since independence in 1957, the five-year economic development plans have emphasized diversification and modernization of agriculture and mineral sectors and development of the export-oriented manufacturing sector, especially resource-based industries. The results of this strategy have been quite encouraging. During the 1970s economic growth averaged a record high of 7.2 percent per year. Major changes during this period were a fall in the share of the agriculture sector from 32 percent in 1970 to 25 percent of GDP in 1979, expansion in the manufacturing sector from 12 percent in 1970 to 19 percent in 1979, and an increase in the importance of the oil sector share in export earnings from 4 percent in 1970 to nearly 16 percent in 1979. These achievements were a result of active government policy and the commodity boom, both for oil and other primary commodities, outlined in the "optimistic" development plans of the government for the 1980s. Basic to these expectations was the assumption of a continued upward trend in commodity prices.

Malaysian economic performance during the 1980s has been determined by periods of shock and adjustment. Two important shocks began the decade. An external shock arose from the general decline in world trade and a recession in the OECD, which also resulted in a deterioration in the external terms of trade. An internal shock arose from the Malaysian government's attempt, during 1980-84, to counter the

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[21] Data for 1990.

external shock by ambitious fiscal expansion involving high annual public sector deficits, which peaked at M$11.3 billion or nearly 18 percent of the GDP in 1982. High economic growth of 7.3 percent was maintained during 1979-84, while inflation peaked from a traditionally low average level of 4.9 percent during 1965-80 to nearly 10 percent in 1981. The growing balance of payments deficit and debt burden indicated the non-sustainability of government policy in the long-run and a need for adjustment in the economy. A domestic energy price hike during 1984-85, involving mainly diesel and kerosene, was one of the measures implemented.

The Energy Sector

Structure of Energy Demand

Over 80 percent of total commercial energy demand is met by petroleum products. The other important sources are electricity (13%) and coal (3%). Users of commercial energy in Malaysia are the industrial and transport sectors, each accounting for 40 percent of the total commercial energy demand. Nearly 75 percent of the industrial sector demand is met by petroleum products, the most important being diesel and fuel oil. The other users of commercial energy are households, which account for around 14 percent.[22] Electricity provides over half of residential sector commercial energy needs, followed by kerosene and LPG. Table 2.1 gives the structure of commercial energy demand.

Energy Policy and Prices

Given the dominance of petroleum product demand in the country, the emphasis of the Malaysian National Energy Policy initiated in 1979 has been diversification and efficiency in the use of the fossil fuels and hydro power. Efficient fuel switching in favor of natural gas and electricity has received high priority by policymakers. Energy pricing policy is considered an important instrument to diversify the fuel-mix. Figure 2.1 shows the first major change in energy prices during 1984-85.

As figure 2.1 shows, the 1984-85 price changes targeted diesel and kerosene, the former being the most important fuel for the industrial sector and the latter being used by the household sector. While gasoline prices were also increased marginally in 1985, electricity prices continued to fall. The negative

[22] A substantial share of households primary energy demand is met by non-commercial sources of energy such as fuel wood, agriculture waste, etc.

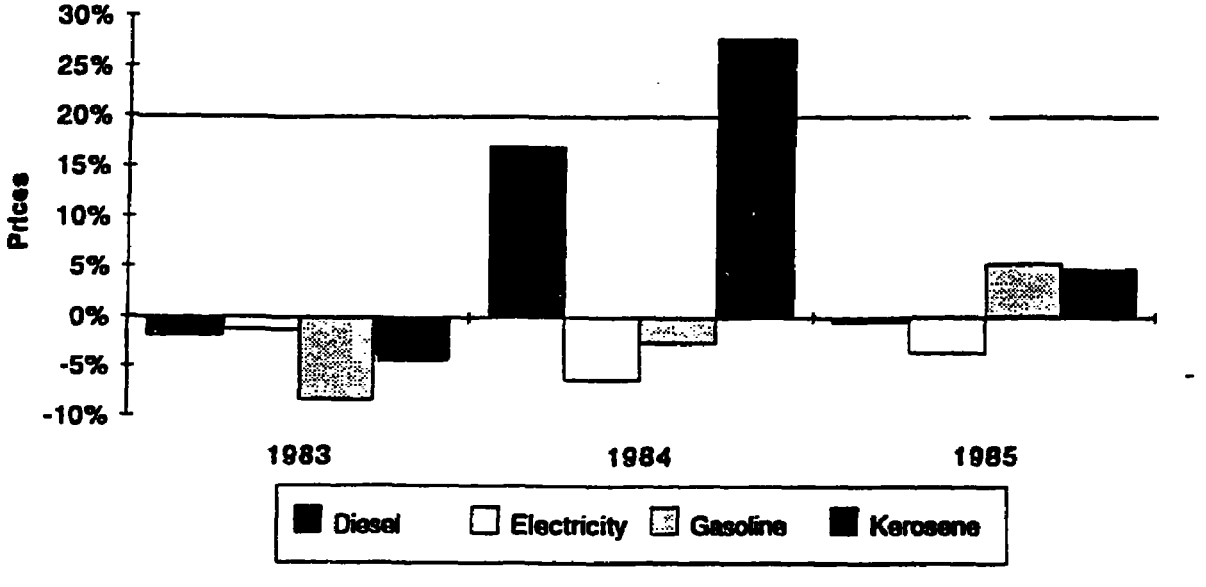
trend in electricity prices was characteristic of the 1980s and should be seen in relation to the overall energy policy of the government to encourage fuel switching from oil to electricity and gas.

Table 2.1: Malaysia: Commercial Energy Demand, 1984 (000 tons oil equivalent)

	Residential and commercial	Industrial	Transport	Total end use	Percent
Natural gas	47	87	-	134	2
Petroleum (total)	488	2,545	3,271	6,304	82
LPG	155	33	-	188	
Gasoline	-	33	1,892	1,925	
Kerosene & aviation turbo fuel	333	24	371	728	
Diesel	-	1,893	1,008	2,901	
Fuel oil	-	528	-	34	
Refinery gas	-	34	-	34	
Coal & coke	-	270	-	270	3
Electricity	553	453	-	1,006	13
Total	1,088	3,355	3,271	7,714	100

Source: World Bank (1987).

Figure 2.1: Malaysia: Energy Price Changes in Malaysia (percentage p.a. in real terms)



Effects of Energy Price Changes

Diesel Price Increases 1984-85: The Industrial Sector

Given the importance of diesel to the industrial sector, what was the impact of 1984-85 diesel price increase for this sector? Industrial subsectors may differ both with respect to the importance of energy inputs in the production process and the ease of substitution between energy and other primary inputs and substitution between different fuels. Table 2.2 shows the structure and growth of production in the industrial sector.

As table 2.2 shows, activities that dominate the Malaysian industrial sector are not particularly energy intensive. The share of energy cost in the total cost of production in different subsectors lies between 0.7-1.9 percent, with the exception of non-metallic mineral products such as ceramic and glass industries where energy cost share is 6.2 percent. The impact of an increase in diesel prices on industrial output depends on the share of diesel in the cost of production, interfuel substitution possibilities and the demand elasticity for output of these sectors. Given the low cost shares, the effect of a diesel price increase on industrial output would be relatively small. For sectors where output demand is inelastic the effect of the price increase on output would be further reduced. The lack of a significant output loss during 1984, as reported above, is to be expected. However, one observes a fall in manufacturing output during 1985, mainly in wood and rubber products and non-metallic mineral products, subsectors where energy cost shares lie between 1.4 and 6.2 percent.

Table 2.2: Malaysia: Index of Industrial Production (1981 = 100) and Energy Cost Shares

	Weight	1982	1983	1984	1985	1986	Energy cost share
Mining	30.4	105.4	132.0	165.4	166.4	192.4	-
Manufacturing	65.7	103.6	112.6	125.4	117.6	126.1	1.4
Food manufacturing	10.6	109.0	109.5	122.9	134.3	154.7	0.7
Wood, wood and cork products	5.5	108.4	121.4	99.9	89.0	90.1	1.9
Industrial chemicals	0.9	86.4	88.7	101.4	106.8	99.5	1.3
Rubber products	1.7	105.7	108.4	119.2	112.9	124.4	1.3
Nonmetallic mineral products	3.5	94.8	99.9	111.3	99.4	58.2	6.2
Electrical machinery	9.8	126.7	148.5	201.3	151.9	-	0.9
Transport equipment	2.0	96.0	111.1	119.7	120.2	72.3	1.3

Note: Energy cost share is defined as energy cost as a percentage of output.

What was the impact of diesel price increase on demand for diesel in the industrial sector? This would depend on both the size of output loss, if any, and the ease of substitution from diesel to other energy inputs. In the present context substitution possibilities are primarily between diesel and electricity. Diesel is used in power generation equipment and demand for diesel for back-up power-generation by industrial consumers in developing countries often arises due to the low reliability of electric power supplies. Erratic power supplies, due to insufficient capacity during system peak hours, impose substantial outage costs in terms of loss of production, damage to electric motors and loss of working hours for labor. Back-up power generation is often used to improve the quality of electricity supplies for production. Producers substitute diesel with electricity during working shifts such that electricity-using production facilities are operated during off-peak hours. Also, substitution between diesel and electricity in the short- and medium-term arises due to the ease of replacing small diesel engines with electric motors. In other words, one would expect greater substitution of electricity for diesel in response to an increase in diesel prices.

Closer observation of the data reveals that prior to the diesel price change in 1983, the share of diesel in industrial energy demand was over 65 percent and it fell to under 50 percent by the end of 1986. In absolute terms, diesel consumption by the industrial sector between 1983 and 1986 fell by nearly 25 percent as a result of a 28 percent increase in prices, implying an arc elasticity of -0.9. The relatively high elasticity of demand is quite reasonable given the substitution possibilities between diesel and electricity. During 1983-85, interfuel substitution data in the industrial sector indicates that consumption and relative shares of electricity, natural gas and coal/coke have increased, while consumption and the share of diesel decreased. Figure 2.2 illustrates the changes in the structure of energy consumption in the industrial sector during the 1980s.

The other important policy issue related to increased diesel prices is the subsidy effect. Figure 2.3 shows the difference between domestic and border prices (as a percentage of domestic price) for diesel.

Kerosene Price Increases 1984-85: The Household Sector

Oil and electricity are the main sources of commercial energy in the household sector. Of the oil products, kerosene is used most often, while more recently the use of electricity and LPG has increased. In the present context, the increase in kerosene prices is directly relevant. The two most important policy issues related to the kerosene price increase in 1984-85 are welfare consequences for households of changes in kerosene prices, and the subsidy effect of these price changes.

Figure 2.2: Malaysia: Energy Consumption of Industrial Sector (share by type of fuel)

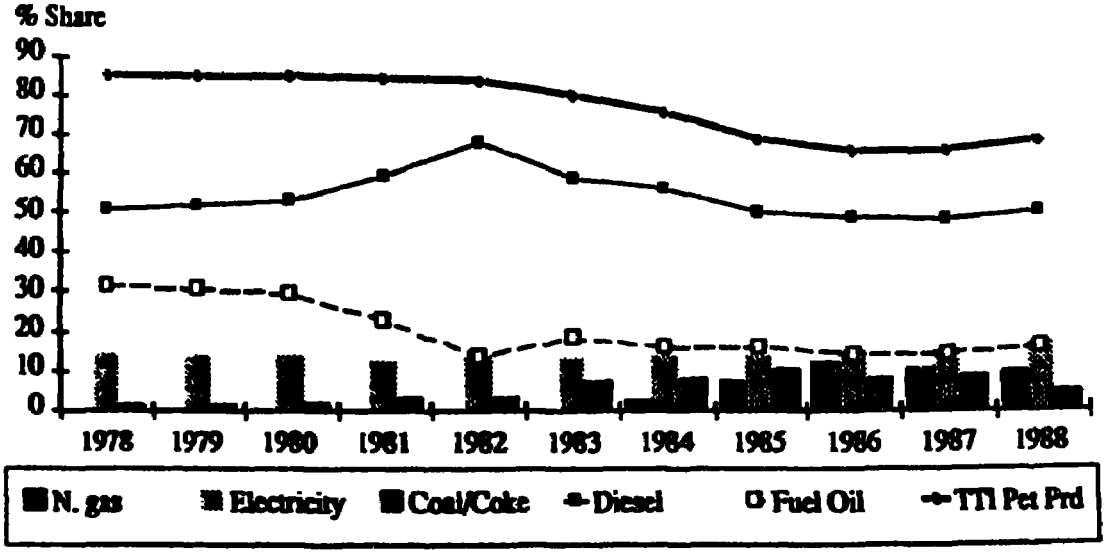
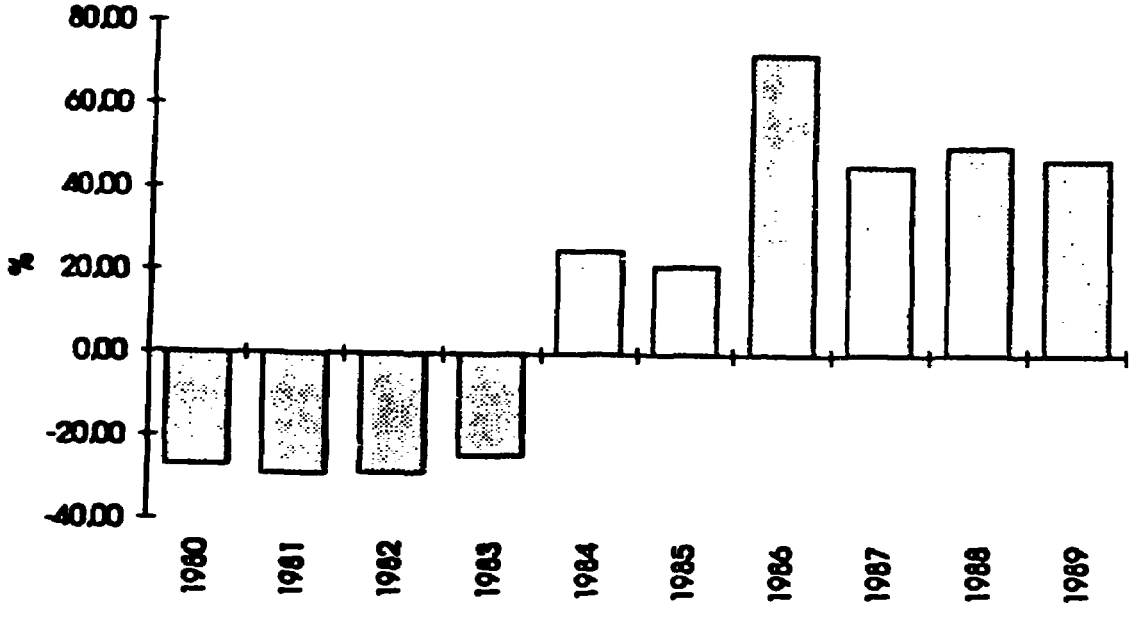


Figure 2.3: Malaysia: Difference between Domestic and Border Prices for Diesel, Subsidy (-), Tax (+)



To calculate welfare consequences (loss in consumer surplus) of an increase in kerosene prices for different households, we need information concerning the share of energy in total household expenditure. Expenditure shares can vary across different groups of households depending on income level, urban/rural nature, and geographic location. Thus, it is reasonable to expect the welfare effects of an energy price increase to also vary across households. Table 2.3 gives the expenditure shares of fuel and power for different categories of households.

Table 2.3: Malaysia: Current Expenditure Shares on Fuel and Power

	Malay		Chinese		Indian		Others	
	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural
Employer	0.08	0.04	0.02	0.01	0.01	-	0.03	-
Employee	0.05	0.04	0.02	0.02	0.04	0.02	0.04	0.01
Self employed	0.01	0.03	0.02	0.02	0.02	0.01	-	-
Others	0.06	0.02	0.09	0.02	0.03	0.06	-	-

Note: The share of consumption expenditures on energy varies across different households. In general, the shares are higher for urban households as compared to rural areas. Realizing that the income levels in the urban areas are higher than in the rural areas, these differences are contrary to expectations given that energy is a normal good with income elasticity less than one. However, the most likely explanation for this outcome lies in the structure of energy consumption in rural areas. A large portion of the energy consumption in rural areas is non-commercial energy whose value is likely to be underestimated in the data underlying above calculations.

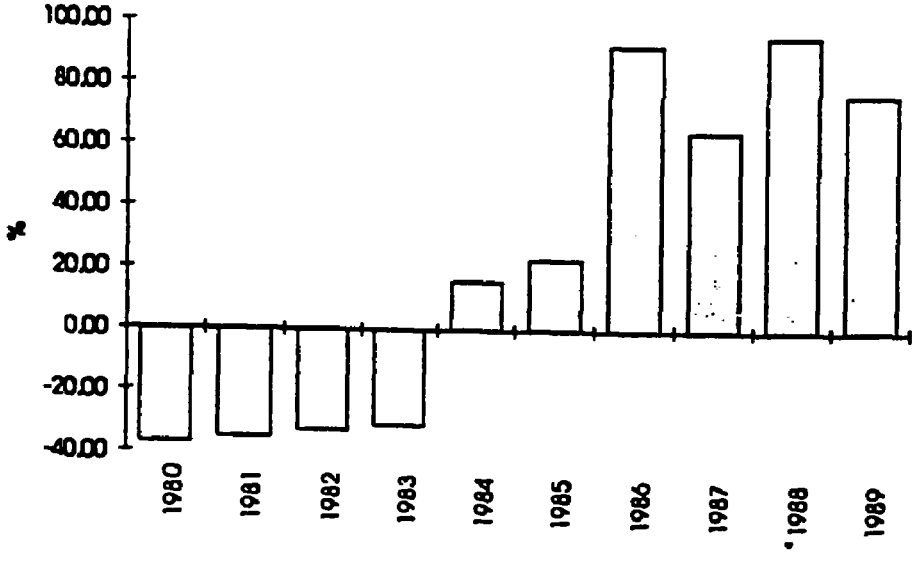
Another important parameter for calculating welfare effects is price elasticity. In the absence of a reliable analysis of residential demand for kerosene for Malaysia, we can draw some indicative estimates for price elasticity by examining the actual response to the change in prices during the 1980s. Kerosene consumption by the household sector between 1983 and 1985 fell by nearly 35 percent as a result of a 33 percent increase in prices, implying an arc elasticity of -0.81. We can illustrate the welfare effect of the price increase as follows: in a household with a per capita consumption of 35 liters of kerosene per month and a budget share for kerosene equal to 4 percent of the total household expenditure,[23] the change in consumer surplus due to the 1984-85 kerosene price increase would be approximately equal to -1.3 percent

[23] Assumptions in this scenario are that a low income urban household has limited access to non-commercial sources of energy and an income of around M$ 400 per month.

of total monthly household expenditure. Assuming a price elasticity of zero, alternatively, an upper bound for the welfare effect for the same household would be 1.5 percent.

The subsidy effect of the increase in kerosene prices was quite substantial. Figure 2.4 shows the domestic and border prices for kerosene for the period 1980-89. As figure 2.4 shows, domestic prices were below the border prices prior to 1984, the first year of the price reform. From 1984 onward domestic prices remained above border prices.

Figure 2.4: Malaysia: Differences between Domestic and Border Prices for Kerosene, Subsidy (-), Tax (+)



Macroeconomic Impacts

What were the macroeconomic impacts of the domestic diesel and kerosene price increases? A crucial factor determining the macroeconomic impact of an energy price hike is the effect on the consumer price index (CPI) and subsequently the response of nominal wage to an increase in CPI. The 1983-84 price increase is reflected in the CPI for rent, fuel and power for the same period. However, the change in CPI is relatively low. This is largely due to the lack of response to kerosene and diesel price changes in the most important item: the price of food. The lack of response of food prices to energy price changes indicates the share of energy inputs to the agricultural sector are low. The other crucial factor determining macroeconomic effects is the response of wages to small changes in CPI during this period. The period 1983-87 has been characterized by rising wage rates and an increased share of wages in national income

while share earned by capital was declining. The reason for these wage increases has been the presence of inflexible labor contracts negotiated during tight labor market conditions around 1983. The wage level of new entrants did not increase. On the contrary, one observes a fall in marginal wage for new entrants from 1984-85.[24] There is little evidence to link wage rises to the increase in energy prices. Table 2.4 gives selected macroeconomic indicators for the Malaysian economy during 1982-87.

Table 2.4: Malaysia: Selected Macroeconomic Indicators, 1982-87 (M$ million)

	1982	1983	1984	1985	1986	1987
GDP	50430	53582	57741	57150	57859	60595
(Percent growth)	5.9	6.3	7.8	-1.0	1.2	4.7
Total revenues	16690	18603	20805	21114	19518	18143
(Percent growth)	-	11.5	11.8	1.5	-8%	-7%
Change in Price Index (% p.a.)						
General price level	3.3	4.9	5.2	-1.5	-8.4	5.0
CPI	5.8	3.7	3.9	0.32	0.7	1.5
Food prices	8.26	0.91	3.7	-2.46	0.24	0.49
Gross rent, fuel & power	6.28	6.53	7.5	4.2	1.58	0.57
Transport & communication	3.34	2.42	4.99	2.17	0.41	3.09

Using the estimate of price elasticity of demand for diesel equal to -0.9 and -0.81 for kerosene, we can assess the revenue effect of the price increases. Had the energy price changes not been implemented, the estimated shortfall[25] in revenues in 1985 due to the 1984-85 price increase would have been equivalent to $M million 398 or 2 percent of the government revenues in the same year. Moreover, actual data for the period indicates a substantial reduction in deficits from 1983 onward and that by 1985 the fiscal deficit was reduced to $M million 5617 or 7.2 percent of GDP. Although this was a period of adjustment and change in government revenues resulting from a number of fiscal policies, an increase in domestic petroleum prices most likely would have been one source of reduction in the public sectors

[24] See World Bank (1988), pp. 31-35.

[25] See annex 1.7 for details related to calculation of Revenue effects. See also discussion of macroeconomic impacts in Chap. 1.

deficit. This is further substantiated by the fact that profitability, measured as the rate of return after tax on assets of the public enterprises (PEs) in the extractive industries, recovered substantially during this period. Because this group of PEs is dominated by PETRONAS, the state-owned oil company whose profits to a large extent are also dependent on domestic petroleum prices, changes in domestic oil product prices would have contributed to better financial performance of this enterprise.[26]

Using 1983 as the base year, GDP growth peaked at 7.8 percent during 1984, the first year of the energy price reform. It was primarily the demand stimulus of the expansionary fiscal policy and the property boom, which started in the early 1980s, that sustained this growth. The negative side of the expansionary fiscal policies and construction boom was a tight labor market with rising real wages and appreciation of real exchange rate, which led to a loss of international competitiveness in the manufacturing sector. The recession in the following year was partly a result of these negative developments and fiscal policy changes which involved, for example, cutbacks in public investment resulting in a withdrawal of the demand stimulus of the early 1980s.

[26] Government revenues from petroleum dividends, increased from M$ 500 million in 1983 to over M$930 million in 1985.

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3. INDONESIA: DIESEL AND KEROSENE PRICE INCREASES 1982-85

Introduction

The Republic of Indonesia has an equatorial climate and covers a total area of 1,905 thousand square kilometers, including half as archepelagic seas separating the islands. It has a total population of 178.2 million and GNP per capita of US$ 570, making it one of the most populous low-income countries in the world.[27]

The Economy

Since the establishment of the "New Order" Government in 1967, Indonesia has developed from a low-income country with per capita income of US$ 50 in 1967 to achieve annual growth rates of per capita income during the last two decades averaging over 4.5 percent per year. Common objectives of economic policies during 1967-84 were to achieve stability, growth and equity. These objectives were outlined in a series of five-year plans (Repelitas), which were open to annual review. In these plans one observes a transition from food production and infrastructure in Repelita I to improvement in living standards and equitable distribution in Repelita II, which ended in March 1979. The achievements during the first two plans were impressive. The second plan period averaged a record 7.7 percent growth per year, with sectoral growth rates averaging 4.6 percent for agriculture and 13 percent for industry. The achievements during this period were a result of active government policies, as outlined in Repelita I and II, and the commodity boom for oil and other primary commodities.

The 1980s began with a favorable external shock initiated by the second international oil price hike, which led to a substantial increase in revenues from the oil sector. Indonesia's revenues from oil export peaked at nearly US$ 16.5 billion in 1981-82. However, the subsequent fall in international oil prices led to a continuous fall in oil revenues to 50 percent by 1985-86, or US$ 9 billion. The prices of other primary exports also fell during this period.[28] These adverse developments set in motion a number of adjustment measures, one of them being an upward revision of domestic energy prices. Substantial domestic energy price increases for petroleum products (except gasoline) and electricity were implemented during 1982-85.

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[27] Data for 1990.

[28] In 1985, the World Bank index of 33 primary commodities was 20 percent below its level in 1979-81 and reached its lowest level in the 27 years since the index has been compiled.

The Energy Sector

Structure of Energy Demand

Primary energy consumption in Indonesia is sourced by commercial and non-commercial energy, where the latter accounts for nearly 60 percent of final demand. The primary sources of commercial energy are oil and gas, with minor shares of electricity and solid fuels. Sectors using commercial energy include industry (35%), transport (28%) and households (21%). Over 80 percent of industrial demand for commercial energy is met by fuel oil and diesel. Another important source is natural gas. Together oil and gas account for over 97 percent of industrial demand. There is a similar pattern of fuel demand by the households, the dominant source being oil, mainly kerosene, with marginal contributions from gas and electricity. Table 3.1 gives the structure of energy demand in Indonesia in 1982, when the first substantial price increase was implemented.

Table 3.1: Indonesia: Primary Energy Consumption by Major Sectors, 1982 (thousand of TOE)

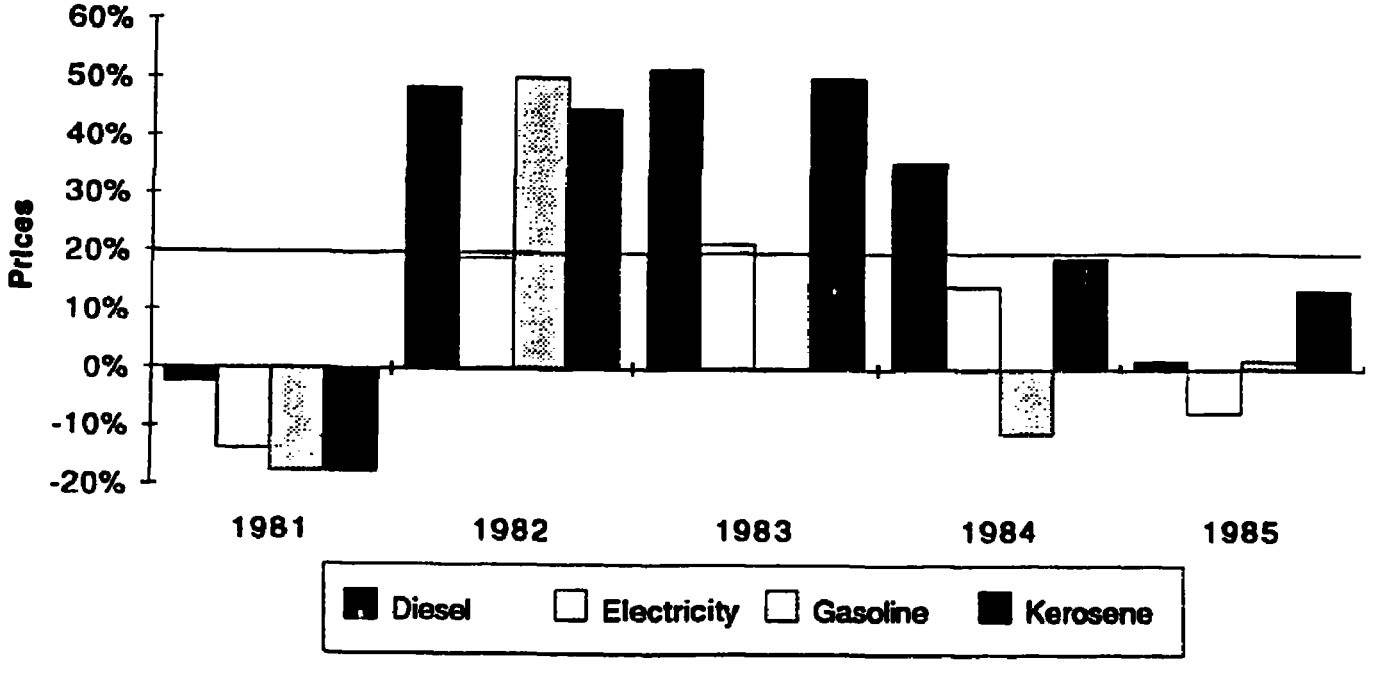
Indonesia	Solid fuels	Oil	Gas	Electricity	Non-comm. fuels	Total
Total final consumption	131	21210	3694	479	38053	63565
Total industry	91	7712	917	238	1808	10765
Iron and steel	18	–	–	–	–	18
Chemical/petrochem.	73	908	917	–	–	1898
Non-spec. industry	6804	–	238	1808		8849
Transportation						
Air	40	7192	–	–	–	7232
Road	–	256	–	–	–	256
Rail	–	6625	–	–	–	6625
International navigation	40	–	–	–	–	40
	–	311	–	–	–	311
Other sectors						
Residential	–	5431	2777	241	36245	44693
Non-spec. other sect.	–	5408	29	–	36245	41682
	–	23	2748	241	–	3011
Non-energy uses	–	875	–	–	–	875

Source: IEA (1984).

Energy Policy and Prices

Domestic energy prices in Indonesia in the early 1980s were highly subsidized. Energy subsidies financed by the budget or from special credit programs of the government of Indonesia during 1981-82 amounted to $2.3 billion, an increase of 40 percent over the previous year. The economic cost, i.e., the difference between domestic and border prices of these subsidies was almost double the budgetary cost and nearly 5.4 percent of GDP in the same year.[29] The first increase in domestic oil products and electricity prices was implemented during 1982-85. This was motivated by the need to reduce the fiscal burden of energy subsidies and to encourage efficient use of energy through pricing that reflected the scarcity of energy resources. Figure 3.1 shows the changes in energy prices implemented during 1981-85.

Figure 3.1: Energy Price Changes in Indonesia
(percentage p.a. in real terms)



[29] See World Bank (1983).

Effects of Energy Price Changes

Diesel Price Increases 1982-85: The Industrial Sector

What was the impact of these price increases on the industrial sector? The output effect of an increase in energy prices are determined by energy costs in total cost of production and elasticity of demand for output for different subsectors. Table 3.2 shows the share of energy in total costs and the index of industrial production for a selected group of industries for the period 1981-88.

As table 3.2 shows, except for glass and glass products, energy cost shares are relatively low and lie between 0.26 percent for tobacco and 2.93 percent for cement. The pattern of changes in output is as expected, with highest output losses for industries with high shares of energy costs and lowest changes in output for those with low energy cost shares. During the first year of the reform, output for glass and glass products fell by nearly 20 percent. For other industries the change in output varied between 0 and 11 percent. Food processing and the tobacco industry did not experience any changes in output. For the whole period of the reform, the largest losses were observed for industries such as yarn and thread, weaving mills and plywood, a sub-group where energy costs constitute a relatively high share of total costs. Loss of output in the motor vehicle industry as fuel costs increased during the period of price reform is as expected. However, the general index of production shows a gradual increase in aggregate output during the period of energy price increases.

The effect of a price increase on demand for individual fuels occurs as a result of a reduction in aggregate demand for energy, interfuel substitution generated by price increases and price elasticity of demand for industrial output. The effect on aggregate demand for energy depends both on the output effect of the energy price change and a substitution effect which occurs between energy and labor. Interfuel substitution on the other hand will be determined by the extent to which relative fuel prices are altered. Given that price changes during 1982-85 covered all petroleum products and electricity, interfuel substitution should be less important. To get an idea about likely effects on energy consumption we may draw upon the findings of an earlier World Bank study (1983), which analyzed energy price changes in Indonesia. Various energy price scenarios were simulated and table 3.3 presents the results of two scenarios.[30] As expected, the change in energy consumption is much higher when wage rates are held constant as compared to wage rates that are allowed to increase by 26 percent. Moreover, the change in

[30] The energy price change scenario underlying these simulations assume increases in product price as follows: Scenario A. electricity (+39%), gasoline (+60%), fuel oil (+66%), diesel (+66%), kerosene (+60%) and a 28 percent increase in wage rates. Scenario B is the same as scenario A except that wage rate is assumed constant. See World Bank (1983).

Table 3.2: Indonesia: Share of Energy in Total Costs and Index of Manufacturing Production by Selected Industry Group, 1981-88

Description	Cost share	Index Manufacturing Output (1975 = 100) 1981	1982	1983	1984	1985	1986	1987	1988
Food processing, milk	1.82	235	239	261	220	207	197	212	229
Malt liquor and malt	1.37	147	170	144	107	119	125	141	138
Clove cigarettes	0.26	180	187	196	224	246	267	296	317
Yarn and thread	2.13	126	121	114	123	111	115	125	125
Weaving mills	2.13	139	130	121	125	127	132	154	166
Knitting mills	1.00	89	81	82	80	84	89	64	75
Footwear	1.41	123	124	153	179	173	174	176	191
Plywood	2.21	471	424	438	418	387	429	557	648
Paper manufacture	2.31	152	152	129	164	182	206	219	335
Basic chemicals	3.71	127	130	132	147	149	155	170	175
Paint, varnish, and	1.25	159	168	147	164	189	199	160	178
Tires and tubes	1.41	301	294	300	300	311	329	356	417
Glass and glass products	7.99	257	209	227	247	250	244	348	417
Cement	2.93	395	419	566	616	686	767	806	858
Structural metal products	1.66	188	196	203	197	214	218	252	291
Radio, TVs	1.17	349	333	351	279	243	217	208	261
Motor vehicles	0.93	256	227	198	179	183	211	233	218
Motor cycles, three	0.93	161	187	130	93	100	128	117	102
General index		214	214	229	241	258	275	290	299

Source: Central Bureau of Statistics.

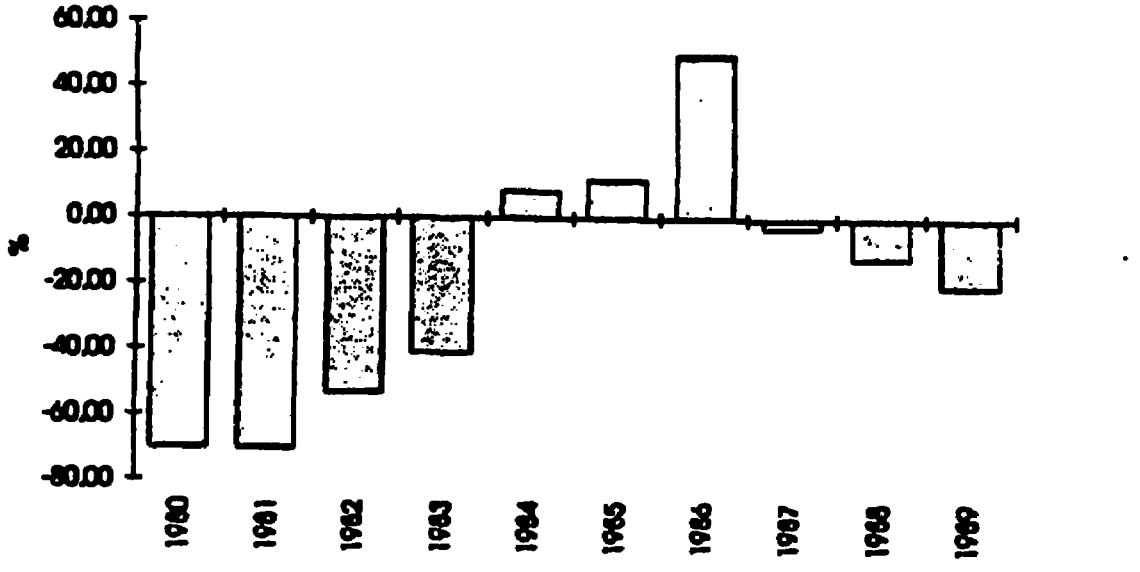
Table 3.3: Indonesia: Changes in Energy Consumption and Subsidy Effects of Domestic Energy Price Changes (percent)

	Scenario A		Scenario B	
Sector	Change in energy	Subsidy	Change in energy	Subsidy
Food processing	-14.04	-24.41	-27.87	-41.69
Other food froducts	-14.40	-26.61	-27.65	-43.68
Beverages	-12.28	-28.26	-26.67	-48.23
Tobacco	-11.34	-33.69	-25.09	-54.89
Spinning and weaving	-8.68	-22.53	-21.76	-43.34
Textiles	-9.31	-24.10	-21.90	-44.40
Wearing apparel	-5.41	-25.82	-14.96	-50.46
Leather and leather substitutes	-10.24	-26.18	-23.01	-46.16
Leather footwear	-7.76	-28.46	-17.74	-49.74
Wood and wood products	-10.19	-31.52	-19.19	-48.93
Wood furniture	-2.67	-31.10	-2.63	-51.09
Paper and paper products	-10.54	-25.80	-20.84	-43.09
Printing and publishing	-5.38	-27.04	-12.89	-49.35
Basic chemicals	-12.54	-25.77	-24.18	-42.56
Other chemical products	-9.44	-29.39	-19.66	-48.71
Rubber	-11.35	-25.29	-23.02	-42.86
Plastic wares	-11.56	-25.84	-23.32	-43.53
Ceramic and porcelain	-11.03	-21.73	-21.92	-37.90
Glass and glass products	-13.18	-21.07	-25.95	-37.12
Cement and cement products	-14.89	-28.06	-30.75	-47.22
Structural clay products	-17.59	-24.16	-32.20	-40.10
Other non-metallic metal products	-17.40	-27.38	-31.49	43.67
Fabricated Metal Products	-11.06	-26.90	-22.99	-45.52
Machinery	-8.22	-25.97	-19.12	-46.72
Electrical machinery	-10.67	-27.83	-22.21	-46.71
Transport equipment	-9.62	-29.44	-20.21	-48.96
Measuring and optical equipment	-6.35	-22.59	-14.97	-43.00

economic subsidies, due to a change in domestic energy prices, is a decrease of between 20 to 33 percent in scenario-A, and an even larger decrease in scenario-B. The difference is due to lower levels of energy consumption in scenario B.[31]

Another important policy issue related to the increase in diesel prices is the subsidy effect. Figure 3.2 shows the relationship between domestic and border prices for diesel for Indonesia during the 1980s. Despite the large price changes, domestic prices for diesel remained below border prices for most of the 1980s.

Figure 3.2: Indonesia: Differences Between Domestic and Border Prices for Diesel Subsidy (-), Tax (+)



Kerosene Price Increases 1982-85: The Household Sector

The major source of commercial energy used in the household sector is kerosene followed by electricity and gas, which have a marginal share in household consumption.[32] Therefore, the increase in kerosene prices is directly relevant for policy purposes.[33] The most important policy issue arising from a

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[31] Revenue effects of the price changes are discussed under macroeconomic impacts of energy price changes.

[32] However, as for many other developing countries, it is the non-commercial sources of energy which satisfy the major portion of household demand for primary energy. For Indonesia, nearly 87 percent of total household energy consumption was satisfied by non-commercial energy.

[33] The effect of changes in electricity prices is of less importance. This is due to the low share of electricity in household consumption in the early 1980s and, at the most, these changes are relevant for middle- and high-income households in urban areas having access to reliable supplies of electricity.

kerosene price increase during 1982-85 is the welfare consequences for households.

Welfare effects of kerosene price changes are often considered more serious for low-income households in urban areas with limited access to non-commercial fuel. Assuming a monthly household expenditure of Rp 15000, with a budget share for kerosene equal to 6 percent[34] and price elasticity equal to -1.02, loss in consumer surplus due to the kerosene price increase during 1982-85 for the household was equivalent to 0.65 to 2.23 percent of monthly household expenditure. The largest welfare loss occurred in 1982-83 when prices increased by nearly 50 percent and the lowest occurred in 1984-85 when the price increase was equal to 14 percent.

Another important policy issue related to an increase in kerosene prices is the subsidy effect. Figure 3.3 shows the relationship between domestic and border prices for kerosene for Indonesia during the1980s. Despite large price changes, domestic prices for kerosene remained below border prices for most of the 1980s.

Macroeconomic Impacts

What were the macroeconomic impacts of the domestic energy price changes during the period 1982-85? The crucial factor determining the macroeconomic impact of an energy price hike is the effect on the consumer price index (CPI) and subsequently the nominal wage response to an increase in CPI. Except for 1985, the CPI was relatively stable during energy price reforms and thus the wage response is less important in this context. Table 3.4 summarizes selected macroeconomic indicators for the Indonesian economy during the early 1980s.

As regards the impact on CPI, there is the direct effect according to the weight of the energy prices. However, there is also the indirect effect via the impact of energy prices on food prices, which does not seem to have been important during the period of energy price increases.[35] An important factor in this context is the intensity of commercial energy use in the agriculture sector and the government policy with respect to the pricing of agricultural inputs. In Indonesia, the main commercial energy intensive inputs in the agriculture sector are chemical fertilizers, which account for around 4.5 percent of the production costs for staple crops such as paddy and maize. However, fertilizers were highly subsidized and their prices were

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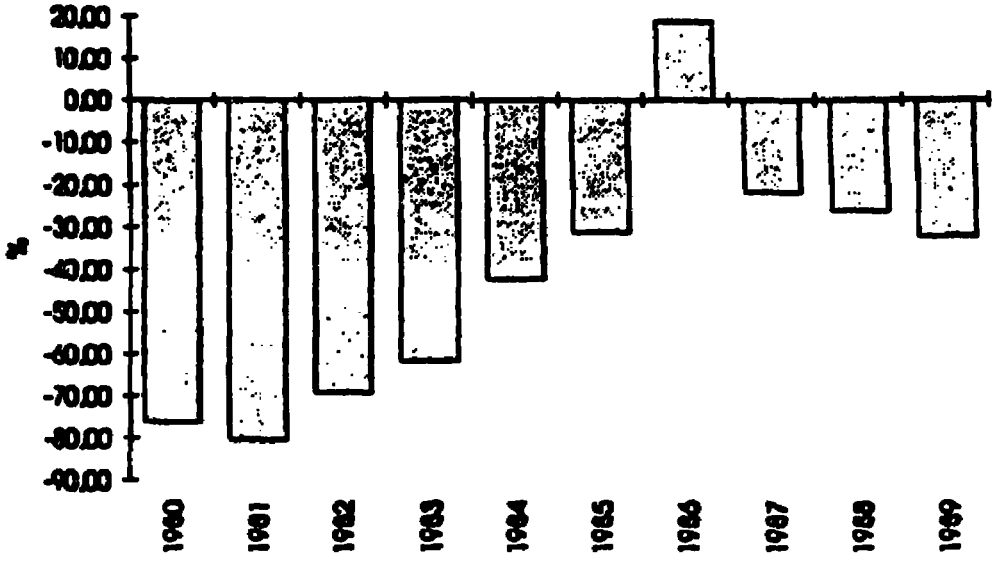
[34] Average kerosene expenditure share of a low income urban household in 1984. See World Bank (1990).

[35] In 1985 the inflation rate was lowest for the past decade. During April and May 1985 there was a slight upward pressure when petroleum prices were increased. However, as the rice crop came on to the market food prices declined and so did the CPI.

falling in real terms until 1986 such that consumption increased by 12.3 percent per year during the period 1980-85. It is unlikely that energy price increases led to any cost-push inflation in agriculture prices via an increase in fertilizer prices. This is also reflected in the food price index where the annual changes have been relatively small.

Figure 3.3: Indonesia: Differences Between Domestic and Border Prices for Kerosene Subsidy (-), Tax (+)



The revenue impact of the price reforms was relatively positive. Had the energy price reforms not been implemented, using the most likely estimates of price elasticity of demand for diesel and kerosene equal to -1, the estimated shortfall[36] in net revenues in 1985 would have been equivalent to Rp billion 3567 or 18.5 percent of the government revenues in the same year. Given the falling international oil prices and export revenues, economic policies focussed on controlling government deficits. Increased revenues from domestic diesel and kerosene price reforms contributed to achieving the budgetary targets. In terms of the revenue effect, the diesel and kerosene price changes were quite effective.

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[36] See annex 1.7 for details related to calculation of revenue effects. See also discussion of macroeconomic impacts in Chap. 1.

Table 3.4: Indonesia: Selected Macroeconomic Indicators, 1980-85
(Rp.billion)

	1980	1981	1982	1983	1984	1985
GDP (1983 prices)	66,674	71,613	71,377	73,698	78,214	79,046
(Percent growth)	---	7.4	-0.4	3.25	6.1	1.06
Total revenues	10,227	12,213	12,418	14,433	15,905	19,253
(Percent growth)	-	19.4	1.7	16.2	10.2	21.0
Change in Price Index (% p.a.)						
Wholesale price index	--	---	---	----	11.0	4.5
CPI	16	7.1	9.7	11.5	8.8	4.3
Food	----	8.71	7.5	10.4	6.5	2.0
Housing	---	8.1	16.0	13.5	13.5	7.2
Others	----	6.1	12.1	17.1	11.3	5.4

The GDP growth during this period was lower than the 1970s. Since 1982, falling international oil prices and export revenues for Indonesia created a need for macroeconomic policies focussed on demand restraint to maintain financial stability, a goal attained at the cost of a fall in GDP growth rates during the period. However, these short-term policies were complemented by structural policy reforms to improve efficiency in economic activities. Domestic energy prices contributed to both these short- and long-term objectives. Although it is difficult to isolate the effects of energy price increase in a macroeconomic environment and a number of policy changes were being implemented at the same time, the positive revenue effect and efficient pricing of energy inputs contributed to the achievement of short-, medium- and long-term objectives of policy makers.

Data Sources

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4. GHANA: DIESEL AND KEROSENE PRICE INCREASES 1983-88

Introduction

Ghana is bordered by Togo, Burkina Faso and Ivory Coast on the Atlantic coast in West Africa. It extends 675 kms inland from the coastline along the Gulf of Guinea and covers a total area of 238,538 square kilometers. It has a total population of 14.9 million and GNP per capita of US$ 390, placing it amongst the low-income countries.[37]

The Economy

At the time of its independence in 1957, Ghana was a middle-income economy with the highest per capita income in West Africa. It later suffered long periods of low growth rates, at 6 percent during the first four years after independence, 2.8 percent during 1960s, and 0.4 percent during the 1970s. The economic decline, which continued into the early 1980s, was a result of external and domestic factors. External factors included fluctuations in international cocoa prices and an increase in international oil prices during the 1970s and early 1980s. Domestic factors were droug.t and poor management that affected the production of cocoa. Since cocoa is the main export commodity, this imposed a severe constraint on import capacity. Factors that led to this outcome were fixed exchange rate policies, which led to over-valuation of the cedi during the 1980s, high level of taxes, and low cocoa producer prices. Deterioration in the country's infrastructure, another internal factor, was both a cause and an effect of the decline in the cocoa sector. The 1979-80 international oil price shock combined with the political instability brought the economy into a total crisis.

The decade of the 1980s started with a military coup that was followed by the establishment of a civilian/military government in late 1981. A number of policy reforms followed: increases in real prices to cocoa producers, and improvement in transport infrastructure and general health services. However, given the severe import constraint and marginal results from policy changes, an externally supported adjustment program managed by the IMF and the World Bank was set in motion in May 1983. Reforms undertaken included instituting a flexible exchange rate policy, increasing cocoa producer prices and public sector wage levels, decontrolling prices, rehabilitating infrastructure and prompt adjustment of

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[37] Data for 1990.

administered prices in line with movements in border prices and exchange rates. Domestic oil price changes in Ghana during 1983-88 were an outcome of the new pricing policy affecting the administered prices.

The Energy Sector

Structure of Energy Demand

Domestic end-use of energy in 1985 was estimated to be 3.4 million toe. The main sources of energy were wood and agriculture residues (64%) and charcoal (10%). Petroleum products and electricity consumption was 844 thousand toe, of which petroleum products accounted for 80 percent. Users of this energy included transport (40%), industry (24%) and agriculture and fishing (9%), with diesel accounting for about 32 percent of the energy consumption in these sectors. Household consumption is included in the residential and the commercial sector,[38] which was around 26 percent. For this sector, kerosene accounted for over half, followed by electricity. Table 4.1 gives the structure of commercial energy demand.

Table 4.1: Ghana: Commercial Energy Demand, 1985
(000 tons oil equivalent)

	Residential and commercial	Industrial	Transport	Agriculture /fishing	Total end use	Percent
Petroleum (total)	177	81	341	74	673	80
LPG	3	2	--	--	5	.5
Gasoline	12	3	208	5	228	27
Kerosene and aviation turbo fuel	121	3	18	1	143	17
Diesel	41	48	114	68	271	32
Fuel Oil	--	25	1	--	26	3
Electricity	46	125	--	--	171	20
Total	**223**	**206**	**341**	**74**	**844**	**100**

Source: Ghana, Ministry of Mines and Energy, Energy Statistics Division.

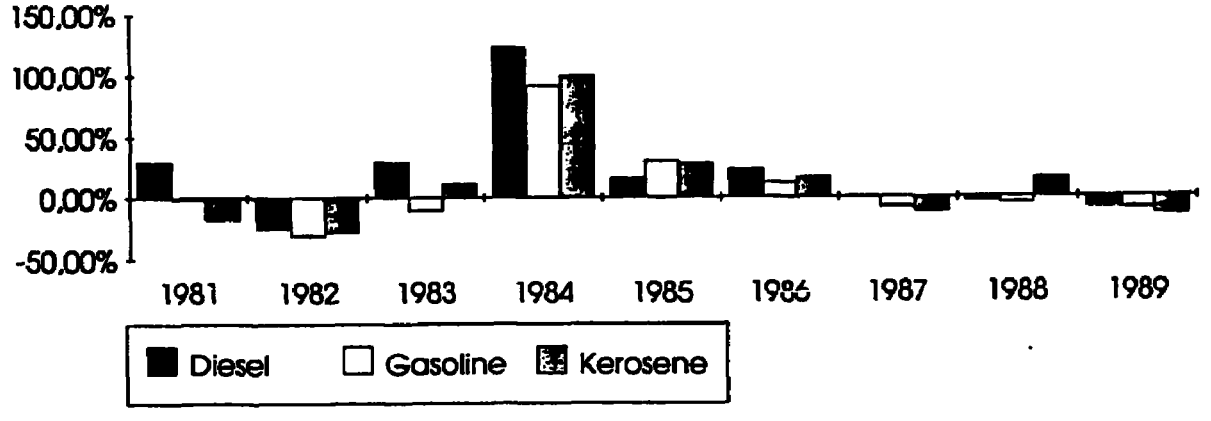
[38] Commercial sector refers to a heterogenous mix of government institutions, schools, government offices, large and small retail and wholesale establishments and services.

Energy Policy and Prices

The externally supported adjustment program set in motion in 1983 laid down long-term development plans for the energy sector. A goal was to reduce dependence on imported crude oil, the largest single import item equivalent to as much as 40 percent of Ghana's total export earnings during the 1980s. Improvement in energy use via pricing reflecting opportunity costs was identified as the most important instrument to achieve this objective. Domestic petroleum product prices prior to the inception of the adjustment program in 1983 were highly subsidized, and the first step toward achieving the goal set forward in the long-term energy sector development plans was an upward adjustment in the administered petroleum product prices. Figure 4.1 shows the changes in domestic energy prices during 1983-87.

As figure 4.1 shows, Ghana experienced sizable domestic petroleum price changes from 1983 through 1987. By 1987, kerosene and diesel prices had risen, in real terms by 161 and 214 percent, respectively, and gasoline prices by 156 percent.

Figure 4.1: Ghana: Domestic Energy Price Changes (percentage p.a. in real terms)



Effects of Energy Price Changes

Diesel Price Increases 1983-88: The Industrial Sector

Given the importance of petroleum products in the industrial sector, it is reasonable to expect that change in domestic energy prices would have had significant consequences for the industrial sector, especially adjustments for diesel. What was the impact of the diesel price increase for this sector? Table 4.2 gives the cost shares and the developments in the index of industrial production for a selected group of industries.

Table 4.2: Ghana: Energy Cost Shares and Index of Industrial Production

	Cost shares			Index of industrial production (1980=100)				
	Fuels	Electricity	Energy	1981	1983	1985	1987	1989
Mining								
Gold	1.39%	4.99%	6.38%	96	78	85	93	116
Diamond	12.05%	7.99%	20.04%	73	30	55	38	33
Bauxite	0.78%	0.61%	1.38%	81	31	75	87	103
Manganese	4.97%	1.78%	6.75%	89	69	126	101	141
Manufacturing								
Milk	2.15%	0.86%	3.02%	119	75	109	175	174
Wheat flour	0.47%	1.30%	1.78%	82	20	51	80	92
Cocoa butter	1.60%	0.59%	2.19%	90	80	70	74	65
Cocoa liqueur	1.60%	0.59%	2.19%	123	69	133	218	238
Cocoa cake	1.60%	0.59%	2.19%	85	90	73	82	67
Beer	0.73%	2.06%	2.78%	118	70	96	132	140
Soft drinks	n.a.	n.a.	n.a.	129	28	53	99	n.a.
Cigarettes	0.27%	0.14%	0.41%	79	53	96	86	80
Cloth	4.51%	2.36%	6.87%	84	19	35	53	61
Jute bags	1.02%	2.42%	3.44%	96	53	75	48	46
Margarine	2.88%	0.96%	3.84%	136	29	101	256	295
Cement	0.80%	2.79%	3.59%	135	94	121	100	152
Iron rods	4.17%	1.21%	5.38%	95	29	62	58	27
Soap	3.13%	0.48%	3.61%	121	41	145	374	419

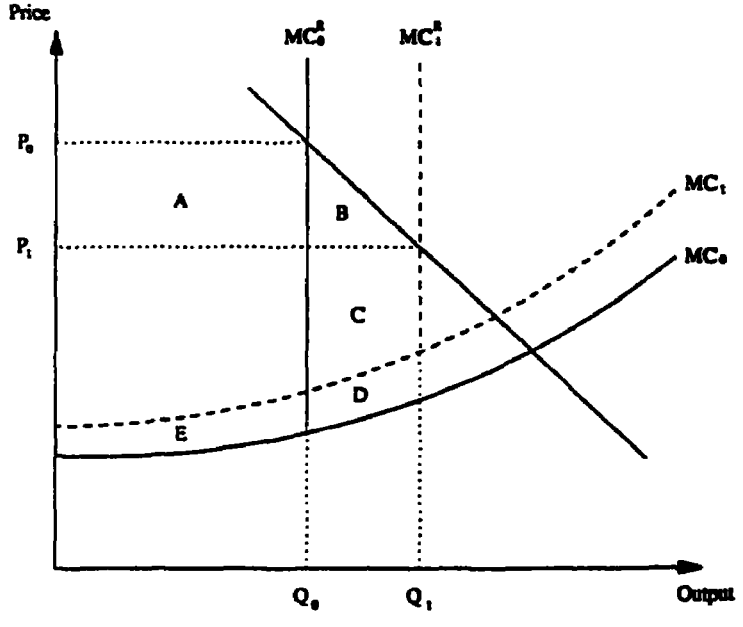
Source: "Ghana: Progress on adjustment," Report No. 9475-Gh, Africa Region, World Bank.

The energy and individual fuel cost shares in Ghana, except for the diamond mining sector, lies between 0.4 and nearly 7 percent. Compared to Malaysia and Indonesia, these cost shares are high, which could be interpreted as lower efficiency in energy use in the industrial sector, but which may also have other causes. However, most industries had their lowest output around 1983, before the energy price increases, with an expansion in output from 1983 to 1989, a result that must reflect other simultaneous changes. Among the energy intensive industries, diamonds and iron rods are the exceptions (not recovering). Others expanded from 1983 onwards through 1989, under and after the energy price increases. One explanation is the presence of the structural constraints in the economy at the time of energy price changes. Administrative controls and constraints on import capacity during the 1970s and 1980s resulted in rationing of important inputs for most firms in the industrial sector, resulting in underutilization of industrial capacity

(utilization around 10-18%).[39] Prices for commodities would then be determined by their scarcity and there were thus high levels of quota rents. An important part of the adjustment program was mobilization of foreign resources from bilateral and multilateral aid programs, and changes in the incentive structure in the cocoa sector.

Such changes result in relaxation of the import constraint, thereby improving the availability of essential inputs to the industrial sector. Liberalization of the economy via abolition of most price controls may thus have been a key factor affecting industrial output. Then, increases in domestic oil prices may have been absorbed via reduction in profit margins while output increased. Figure 4.2 provides an illustration of such a situation. The dotted, upward-sloping marginal cost curve represents the curve shifted upward by input price increase, while the simultaneous outward shift in a binding constraint (on imported inputs, say) explains why output expands.

Figure 4.2: Effects of an Increase in Both Energy Prices and the Supply of Rationed Production Factors (from scenario 0 to scenario 1)



Change in output	$= Q_1 - Q_0 > 0$
Change in consumer surplus	$= A + B$
Change in rents	$= -A + C - E$
Change in government revenues	$= E + D$

[39] See World Bank (1991) p. 9, Table 4.

What was the impact on demand for diesel during this period? In line with the increase in output, diesel consumption increased most years during the period, reflecting that other influences were stronger than the cost increases.

Another important policy issue related to the increase in diesel prices is the subsidy effect. Figure 4.3 shows the relationship between domestic and border prices for diesel during the 1980s.

Figure 4.3: Ghana: Differences between Domestic and Border Prices for Diesel Subsidy (-), Tax (+)

Kerosene Price Changes 1987-88: The Household Sector

The main sources of commercial energy in the household sector are kerosene and electricity. During the period 1984-88, there was a significant increase in kerosene prices. What were the welfare impacts of these price changes?

To calculate the welfare consequences (loss in consumer surplus) of an increase in kerosene prices for different households we need to disaggregate information concerning the budget shares and price elasticity of demand for kerosene for the relevant households. Table 4.3 gives the budget shares of energy expenditures for different income groups.

As table 4.3 shows, an important characteristic of kerosene consumption expenditures is that expenditure shares are declining in total expenditures, reflecting that kerosene is a major fuel for the poor. Thus, for a given kerosene price increase, poorer households would be more affected in terms of percent of their budget. It is important to obtain information about the price elasticity of demand for kerosene to quantify the welfare effects. However, given the absence of a reliable analysis of demand for kerosene in Ghana, such estimates are not available. Table 4.4 estimates loss in consumer surplus for alternative magnitudes of price elasticity for households disaggregated on the basis of total household expenditures. Welfare loss for the average real increase from 1983 to 1987 is expressed as a percentage of total expenditures for the relevant group of households.

Table 4.3: Ghana Households: Energy Budget Shares

	Electricity	Kerosene	Energy total
Quintile 1	0.16%	2.6%	6.45%
Quintile 2	0.11%	3.57%	2.17%
Quintile 3	0.18%	1.46%	1.95%
Quintile 4	0.22%	1.24%	1.68%
Quintile 5	0.21%	0.77%	0.21%

Note: Shares based on the first year (September-August 1987) results of the Ghana Living Standards Survey.

Table 4.4: Ghana: Estimated Welfare Effects of 39 Percent Kerosene Price Change (average for 1983-87 in real terms)

Expenditure group	Consumption (liters/year)	Expenditure share (%)	Loss in consumer surplus* percent		
			$\eta = 0$	$\eta = -0.5$	$\eta = -1$
Quintile 1	158.74	2.61	1.02	0.9	0.78
Quintile 2	388.82	3.57	1.4	1.23	1.06
Quintile 3	223.68	1.46	0.57	0.5	0.43
Quintile 4	270.38	1.24	0.49	0.43	0.37
Quintile 5	318.3	0.77	0.3	0.27	0.23

*Loss in consumer surplus expressed as a percent of total household expenditures at alternative price elasticities, η .
Note: The average real increase for the years 1983-87, 39 percent, is used as a basis in these calculations.
Consumption and expenditure share based on the first year (September-August 1987) results of the Ghana Living Standards Survey.

The above estimates show that welfare effects vary according to the household group. In general, households falling in the second quintile lose the most, in share of total expenditures, when kerosene prices increase. This is due to the high share of kerosene in total expenditures of this group. The welfare loss is also dependent on price elasticity. When household consumption is more flexible, the higher price elasticity means lowered effects on household welfare. Loss of welfare for the poorest households is in the range of one to 0.8 percent of their budget (or around 1800 1987 Cedis), and, for the wealthier, in the range of 0.3 to 0.2 percent (or around 3600 Cedis).

The subsidy effect of the increase in kerosene prices was quite substantial. Figure 4.4 gives the relationship between domestic and border prices for kerosene. In general, from 1986 onward domestic kerosene prices were above border prices.

Figure 4.4: Ghana: Differences between Domestic and Border Prices for Kerosene Subsidy (-), Tax (+)

Macroeconomic Impacts

As shown in table 4.5, there was steady growth in GDP during the time of energy price reforms. Most of the increases in domestic petroleum prices were a result of the government's policy to adjust domestic administered prices in line with the exchange rate changes made under the wider adjustment program initiated in 1983. Thus, the inflationary impact of petroleum price changes would be part of the total inflationary impact of exchange rate adjustments. During the early 1980s, prices for most commodities were determined by their scarcity, which was widespread at the time, thereby resulting in large rents for producers and traders. In such an environment, the impact of changes in petroleum prices would depend on the extent to which traders are able to pass on the price increases to the consumers in order to maintain their profit margins. Since petroleum price changes took place during the time of widespread policy reforms—implemented to reduce the general shortage of goods via improvements in import capacity—it is most likely that petroleum price increases resulted in adjustments in rents and profit margins of the traders, resulting in a mitigated effect on consumer prices. This is substantiated by the relatively low levels of inflation even though the exchange rate had rapidly appreciated under the stabilization program. The surge in food prices during 1987 was most likely due to a fall in agriculture production caused by unfavorable weather conditions rather than changes in exchange rates and petroleum prices. Table 4.5 summarizes selected macroeconomic indicators for Ghana.

Table 4.5: Ghana: Selected Macroeconomic Indicators, 1984-89
(Cedis million)

	1982	1983	1984	1985	1986	1987	1988	1989
GDP (1975 prices)	4974	4747	5158	5420	5702	5976	6312	6633
Percent growth	-6.9	-4.6	8.6	5.1	5.2	4.8	5.6	5.1
Current Revenues *			20813	37071	65889	98972	130939	171827
Percent growth			-	78	78	50	32	31
Change in Price Index (%pa)								
CPI			-	10.38	24.56	39.82	31.36	25.23
Food			-	-11.14	20.28	38.49	34.10	25.08
Gross rent, fuel & power			-	7.32	42.53	40.22	35.52	25.04
Transport & communication			-	53.87	34.23	34.37	30.53	30.35

* Total revenues (less foreign grants).

As regards the revenue effects of petroleum price changes, a simple calculation can be made assuming zero price elasticities. If prices for kerosene and diesel had been kept constant in real terms, rather than increasing by 161 and 214 percent, respectively, the annual shortfall would have been 21729 million Cedis, or 17 percent of government revenues in 1988. At more elastic demands the implied shortfall would be even larger given that subsidized goods would be sold in larger quantities.

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5. ZIMBABWE: ELECTRICITY PRICE INCREASES 1983-84

Introduction

Zimbabwe is a landlocked country situated in the center of southern Africa covering a total area of 391,000 square kilometers. It has a total population of 9.8 million and GNP per capita of US$ 640, placing it amongst the low middle-income countries in Africa.[41]

The Economy

Zimbabwe is a relatively industrialized African country with an annual GDP growth rate of 2.9 percent during the 1980s. At the time of independence in 1980, it inherited a well-diversified economy with yearly average growth rates of over 5 percent during 1965-80, although toward the end of this period, from 1975 onward, the economy had declined by 3 percent, mainly as a result of the civil war and unusual droughts. The country started with a developed modern sector with industry (25% of GDP in 1979) and commercial agriculture (11%). The country also inherited an extremely skewed distribution of income in favor of white households.

The 1980s started with implementation of the Growth with Equity program. Elements of the program included liberalization of foreign exchange, increase in agriculture producer prices and increased investment in transport infrastructure. These elements were based on the government's expectations of expansion in exports and increase in concessional assistance. The equity part of the program involved rapid expansion in education and health services, increase in minimum wages and agricultural resettlement schemes. These policies, combined with favorable weather conditions and growth in foreign assistance, resulted in a sharp economic recovery in the country with GDP growth of nearly 10 percent in 1981.

However, the boom in 1980-81 was short lived. Growth in exports was much lower than expected, as traditional mining and agriculture exports did not expand. Manufactured exports also did not respond as expected. Shortfall in exports was a result of a number of factors, among them an increase in domestic demand, loss in international competitiveness due to domestic wage increases and appreciation of exchanges rates and the general world recession. In addition, concessional foreign assistance was delayed, resulting in the government's increased dependence on high-cost short-term commercial borrowing. As a result the current account deficit increased from Z$ 158 mil. in 1980 to Z$ 703 mil. in 1981. By 1982 a

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[41] Data for 1990.

major change in policy was initiated. The government increased controlled prices on food, utility and rail tariffs and increased electricity prices 95 percent over a period of two years, 1983-84.

The Energy Sector

Structure of Energy Demand

Net energy consumption in Zimbabwe at the time of the first domestic electricity price increase in 1982 was estimated to be 5056 thousand toe. Non-commercial fuels accounted for more than half (55%) of net energy consumption. Total commercial energy (coal, petroleum and electricity) consumption was 2303 toe, of which coal accounted for nearly half (47%), the rest being provided by petroleum (26%) and electricity (27%). Users of commercial energy were industry (54%), transport (24%) and households (22%), which includes the commercial sector. The main fuels for industry were coal (53%) and electricity (34%), which together accounted for nearly 87 percent of commercial energy consumption in this sector, the rest being provided by petroleum products. The transport sector was highly dependent on oil. For the household sector, which also includes the consumption of the commercial sector,[42] the main commercial fuels were coal (54%) and electricity (40%).

Zimbabwe has large domestic reserves of coal. There is also ample access to electricity both from domestic hydro and thermal sources and via imports from Zambia. There are no reserves of oil and the landlocked location of the country imposes high transportation costs for imported oil. All these factors were reflected in domestic consumption where domestic resource and imports of electricity from Zambia provided most of commercial energy. Table 5.1 gives the structure of commercial energy demand in 1982.

Table 5.1: Zimbabwe: Primary Energy Consumption by Major Sectors, 1982 (000' toe)

	Solid fuels	Oil	Electricity	Non-commercial fuels	Total
Total	1095	596	612	2790	5056
Industry	648	161	414	450	1673
Transportation	144	403	-	-	547
Other sectors	267	32	198	2340	2836
Other non-specified	-	-	-	-	-

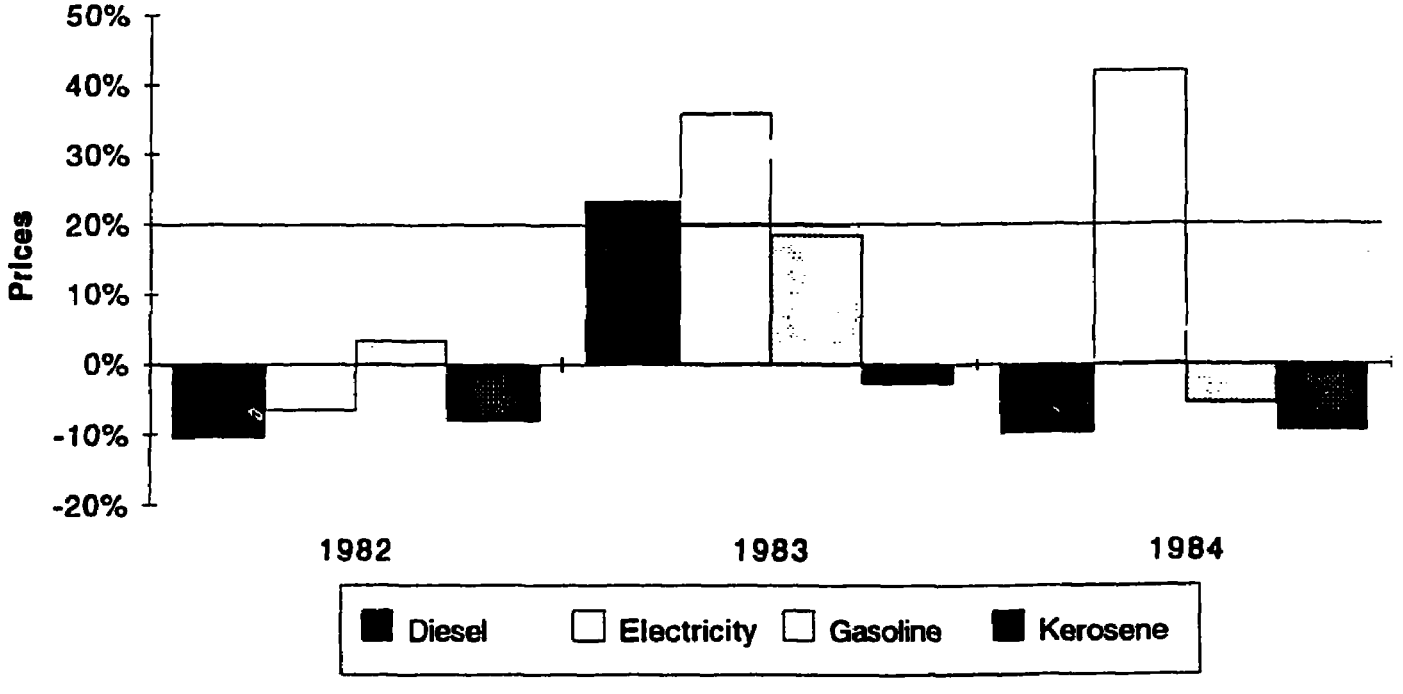
Source: IEA (1984).

[42] Commercial sector refers to a heterogenous mix of government institutions, schools, government offices, large and small retail and wholesale establishments and services.

Energy Policy and Prices

Among the measures in the government policy package set in motion in 1982 were depreciation of the Zimbabwean Dollar by 25 percent between December 1982 and January 1983 and a major increase in taxes and utility tariffs, including electricity. Given that nearly 38 percent of domestic electricity consumption was imported from Zambia at the time, increases in domestic utility prices were an important measure of the effect of devaluation in consumer prices. A general increase in low domestic electricity prices was also undertaken to mobilize revenues from the mostly state-owned electricity sector. Consequently, a sizable increase in domestic electricity prices was implemented between 1983-84, when prices were increased by nearly 95 percent. Figure 5.1 shows the changes in domestic energy prices in Zimbabwe during 1982-84.

Figure 5.1: Energy Price Changes in Zimbabwe (percentage p.a.)



Effects of Energy Price Changes

Electricity Price Increases 1983-84: The Industrial Sector

Given the dominance of electricity consumption by the industrial sector it is reasonable to expect an increase in electricity prices to have had significant consequences for the industrial sector. What was the impact of 1983-84 electricity price increase for this sector? To assess the impacts it is important to examine

the composition of electricity demand in the industry at the time of these price increases. Table 5.2 gives the composition of electricity demand for broad consumer groups.

Table 5.2: Zimbabwe: Electrical Energy used by Broad Consumer Groups (millions of kWh)

	1981	1982	1983	1984
Industry total	5417	5562	5215	5328
Commercial agriculture	541.3	673.1	650.0	592.1
Mining	1360.3	1331.1	1271.9	1272.3
Manufacturing*	3516.1	3558.0	3293.9	3463.6
Domestic consumers**	990.8	987.9	926.6	925.9
Others	728.9	764.9	827.8	958.6
Total	**7137.4**	**7316.9**	**6970.2**	**7212.5**

*Electricity consumption in the manufacturing sector was dominated by electricity intensive industry where the four major consumers, Sabel Chemicals (fertilizers), Rodall Ltd. and Rhomet (Ferochrome) and Zisco (steel) together in 1981 accounted for over 83 percent of the consumption in this sector.

** Domestic electricity consumption was limited to urban consumers as the degree of rural electrification was relatively low.

As table 5.2 shows, over two-thirds of the electricity in the industrial sector was consumed by manufacturing, followed by mining, which accounted for a quarter and the rest was consumed by commercial agriculture and forestry. Within the manufacturing sector, electricity consumption was dominated by electricity-intensive industries, mainly metals (ferochrome and steel) and fertilizers. Electricity intensive industries such as fertilizers and metals are quite inflexible with respect to interfuel substitution and the share of electricity in the unit cost of production is high. Also, the metal industries are price takers in the highly competitive international metal market. Table 5.3 gives the index of industrial production for a selected group of industries in Zimbabwe at the time of an electricity price increase.

Table 5.3: Zimbabwe: Index of Industrial Production (1980 = 100)

Sector	Weight	1981	1982	1983	1984
Minerals					
Chrome ore	45	96.9	78.0	78.0	86.1
Nickel	136	86.4	88.3	67.3	68.0
Iron Ore	36	67.5	51.6	57.0	57.0
Cobalt	7	81.9	86.0	63.4	67.0
Aggregate	1000	95.9	96.4	92.8	97.0
Manufacturing					
Food	135	108.4	123.7	126.9	119.4
Soft drinks and tobacco	104	89.4	91.7	90.1	86.8
Textiles	101	111.6	118.8	108.8	124.1
Clothing & footwear	72	128.4	118.6	109.2	99.9
Wood & furniture	44	103.4	85.8	82.3	81.6
Paper & printing	61	112.4	112.3	106.2	95.0
Chemical & petro.	125	116.6	118.2	121.4	112.2
Non metallic minerals	37	118.0	109.7	105.4	99.0
Metals	288	104.8	96.4	94.8	89.4
Transport equipment	21	155.0	178.4	145.6	114.7
Other manufacturing	12	95.6	80.0	76.6	50.9
Aggregate	1000	100.4	108.7	105.8	100.7

Source: Government of Zimbabwe (1989).

Table 5.3 shows that mineral output declined during 1982-83 as did manufacturing output during 1983-84. The decline in the metals subsector, which accounts for over 80 percent of the electricity consumption of the industrial sector, was significant. This occurred despite the fact that the metal industry enjoys lower tariffs and lower than average increases in electricity prices. The decline in output is expected, both due to limited interfuel substitution and the large electricity cost share in these industries. The competitive nature of the international metal markets and the general fall in demand due to the recession in the OECD were also the factors that further limited the possibilities for passing through increases in costs to final consumers. This fall in output also affected the raw material mining sector. Fall in output of food and agro-based manufactures was most likely caused by severe drought during this period.

What was the impact of electricity price increase on demand for electricity in the mining and manufacturing subsectors during this period? In line with output losses, there was a decline in electricity demand in these sectors. Table 5.4 shows the effect on electricity demand during the period 1982 to 1984.

Table 5.4: Zimbabwe: Change in Demand for Electricity, 1982-84 and Implied Arc Elasticities

	Change in demand (mil. kWh)	Price elasticities*
Agriculture	-81 (12.03%)	0.13
Mining	-58.8 (4.42%)	0.05
Manufacturing	-94.4 (2.65%)	0.03
Domestic consumers	-62 (6.28%)	0.07

* Arc elasticities are calculated on the basis of the price changes during 1983-84.

The low arc elasticities implied by these price increases indicate the inflexible nature of electricity demand in Zimbabwe. For the industrial sector, the fall in demand was mainly due to the output effect of the price increase as interfuel substitution in the industry is limited. The inelastic nature of electricity demand also indicates the revenue-raising potential of the electricity sector. However, to what extent this potential is actually realized depends on the government's ability to extract the increase in revenues from the state-owned electricity sector.

Electricity Price Increases 1983-84: The Household Sector

The structure of power supply at the time of the revisions in electricity prices during 1983-84 catered mostly to urban households and rural electrification was low. Given the disparities in income distribution in Zimbabwe, an important policy issue was the impact of electricity price changes on the welfare of the poor. Table 5.5 gives an estimate of the welfare impact of electricity price changes for a low-income urban household.

Table 5.5: Zimbabwe: Urban Low-Income Household Electricity Consumption, Expenditure Shares, Elasticities and Estimated Welfare Effects*

	1982-83	1983-84
Expenditure share	0.04	0.05
Price elasticity	0.08	0.08
Consumption (kWh)	177.78	177.73
Welfare effect**	-1.42%	-2.2%

* Households with income equal to Z$ 100, i.e., the median income of quintile 1 and 2.
** Loss in consumer surplus expressed as a percentage of total income.

Welfare impacts, defined as the loss in consumer surplus, were equivalent to -1.4 and -2.2 percent of the household income of Z$ 100.

Macroeconomic Impacts

From 1981 to 1984 the increase in consumer prices was high compared to the usual inflation rate of around 6 percent during 1973-79. Inflation peaked at 18.4 percent during 1981-82. However, major factors causing inflation were already in effect before the 1983-84 increase in electricity prices was implemented. A number of changes in the economy during this period were responsible for high inflation rate, including the increase in wages and liberal government employment policies (implemented to correct the pre-independence racially-based salary and employment structure), increase in government expenditures to expand social programs and rehabilitate the country's infrastructure, increase in domestic credit, and severe drought conditions in 1982 and 1983, which reduced agriculture output by nearly 12 percent and real value-added by over 5 percent between 1981 and 1983. Table 5.6 summarizes the selected macroeconomic indicators.

Table 5.6: Zimbabwe: Selected Macroeconomic Indicators, 1980-85
(Z$ million)

	1980	1981	1982	1983	1984	1985
GDP (1980 prices)	3224	3537	3588	3459	3540	3808
(Percent growth)	10.7	9.7	1.4	-4.6	2.3	7.6
Government revenues	950.9	13645	1789.2	2000.5	2212.8	2618.8
(Percent growth)	-	43.5	31.1	11.8	10.6	18.4
Change in Price Index (% p.a.)						
CPI	9.2	14.6	18.4	16.4	12.5	9.9
	(5.4)	(13.1)	(10.7)	(23.1)	(20.2)	(8.5)
Food, weight =20.5 (54.9)	-	13.4	11.4	20.4	20.9	9.1
		(12)	(10.5)	(28.5)	(25)	(6.8)
Rent & rates, weight =19.8 (18.4)	-	10.1	26.1	5	4	5.4
	-	(7.2)	(9.5)	(14.7)	(12.7)	(10.3)
Fuel & lights, weight = 2.9	-	15.9	8.8	48.5	31	3.1

Note: Figures in brackets are for low-income groups. Figures for rents and rates for low-income groups include fuel and lights.

The drastic fall in GDP during 1982-84 was partly caused by severe drought conditions, which resulted in a fall in agriculture output. The direct impact of electricity price increases was felt in the output of electricity-intensive industry in the manufacturing sector, which accounts for over 80 percent of the electricity consumption in this sector. The fall in minerals and metal output was a result of both a fall in international demand and a loss of industry's international competitiveness due to both the wage increases and an increase in power and transportation tariffs. In this respect, the timing of the increase in power tariffs was perhaps unfortunate.

Increases in electricity prices were implemented as a part of a stabilization program to reduce government deficits via reduction in subsidies. As for the fiscal effects of electricity price changes, assuming price elasticity of demand for electricity equal to zero, had the price reforms during 1983-84 not been implemented the estimated shortfall in revenues in 1984 would have been equal to Z$ 157 mil. or 6 percent of the government revenues in the same year.[43]

The stabilization program, which was started in 1982-83, also involved a wage freeze and most likely an increase in consumer prices, of which food and utility tariffs were the most important. This led to a fall in real wages, thereby mitigating the wage gains resulting from liberal wage policies implemented immediately after independence.

[43] See annex 1.7 for details related to calculation of revenue effects. See also discussion of macroeconomic impacts in Chap. 1.

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6. COLOMBIA: ELECTRICITY PRICE INCREASES 1985-88

Introduction

Colombia, situated in Latin America, covers an area of 1,139 thousand square kilometers and has a total population of 32.3 million. A GNP per capita of US$ 1260 places it amongst the low middle-income group of countries in the region.[44]

The Economy

Colombia is a traditionally well-diversified economy with an annual GDP growth rate of around 5 percent until the first half of the 1980s, when the average growth fell to 2.1 percent. Economic performance during the 1970s was satisfactory with average yearly growth in GDP equal to 5.7 percent, a result of high levels of investment averaging 18.7 percent. These levels were maintained through domestic savings of about 19.7 percent of GDP during the coffee boom of 1975-80, although foreign savings of around 2.9 percent also contributed to growth in investment. An aspect of the coffee boom was the expansion in aggregate demand, which resulted in higher inflation. When coffee prices fell in the early 1980s, the government responded by maintaining aggregate demand through high public expenditures, domestic credit creation and foreign borrowing, which resulted in further inflation peaking at 25 percent during 1981-83, and real exchange rate appreciation. The resulting loss of competitiveness and fall in the share of tradables in GDP combined with the general world recession and tightening of the international capital markets led to a sharp fall in reserves. At the same time growth in GDP dropped to 1.3 percent per year. The immediate policy problem was to restore external balance via reduction in aggregate expenditures, especially those items affecting the balance of payments. An adjustment program was set in motion during 1984-86, with the important objective of improving the public deficit and adjusting public sector tariff policies.

In the energy sector, electricity is of particular significance in this context. This chapter examines the impact of electricity price changes during 1985-88. From 1979 to 1985, the energy sector absorbed nearly half of all public investment resources and two-thirds of this was for electricity. A large portion of this investment was financed via foreign borrowing, a trend that continued throughout the 1980s.[45] The

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[44] Data for 1990.

[45] See annex 1.

debt service of the power sector by 1989-90 was estimated to be about US$ 1.1 billion per year, or about 2.7 percent of GDP, which put an enormous burden on the economy. Moreover, internal savings of the sector have been negative. Net revenues from sales covered less than 40 percent of the principal due on existing debt, creating high deficits and contributing greatly to public sector deficits during the 1980s. A need to improve the internal savings rate of this sector has been one focus of economic policy during the 1980s. Increases in electricity prices during 1985-88 were implemented to increase internal savings and improve utilization of scarce resources. This issue will continue to be important given new investments planned for this sector during the 1990s.

The Energy Sector

Structure of Energy Demand

Net commercial energy consumption in Colombia was 13931 thousand toe in 1988. Oil accounted for 64 percent of commercial energy consumption followed by electricity and coal, each accounting for 15 percent. The rest was provided by gas. Users of commercial energy were industry (33%), transport (40%) and residential sectors (14%), with agriculture, commerce and public services accounting for the rest (9%). Fuels used by industry in order of consumption were coal (40%), oil (26%), gas (17%) and electricity (17%). For the household sector, commercial fuels consumed were electricity (48%) and oil (39%), the rest being provided by coal and gas. Table 6.1 gives the structure of commercial energy demand for 1985 and 1988.

Electricity Policy and Prices

The electricity pricing policy as stated in the 1968 decree that created the tariff regulatory authority Junta Nacional de Tarifas (JNT) reads as follows:

> Tariffs should be based on the real cost of service and generate a sufficient return, so as to provide adequate financing of the investment programs of the utilities and should be adjusted promptly to reflect the evolution of costs. Tariffs should also take into account the ability to pay of low-income customers.

Table 6.1: Colombia: Primary Energy Consumption by Major Sector for 1988 and 1985 (000' toe)

	Coal	Oil	Gas	Electricity	Total
Total	2030.9 (1915.4)	8880.9 (7949.5)	933.6 (815.1)	2085.5 (1706.8)	13930.8 (12386.9)
Industry	1848.9 (1730.2)	1213.4 (900.8)	844.4 (782.7)	723.6 (529.8)	4630.2 (3943.5)
Transportation	2.6 (2.6)	5561.7 (4981.2)	- -	0.3 (0.3)	5564.5 (4984.1)
Residential	179.4 (182.7)	774.8 (693.5)	85.3 (31.7)	958.5 (801.6)	1998 (1709.5)
Other sectors	- -	1063.2 (1207)	3.9 (0.7)	403.1 (375.1)	1470.2 (1582.7)

Note: Figures in bracket are for 1985.
Source: IEA Energy Balances.

Despite the emphasis on cost recovery, in practice electricity prices have been low with large price differentials between different consumer groups, i.e., industrial and commercial consumer prices being much higher than prices for residential consumers. Electricity price increases during 1985-88 attempted to rectify this situation. Figure 6.1 shows the changes in energy prices in Colombia during 1984-1988. As the figure shows, electricity prices were increased gradually during 1985-86 with a major adjustment in 1988.

The figure also shows that changes in electricity prices were not uniform across consumer sectors. Table 6.2 gives electricity prices for different sectors during the 1980s.

Effects of Energy Price Changes

Electricity Price Increases 1985-88: The Industrial Sector

Industrial and commercial users were most affected by these price changes. What was the impact of 1985-88 electricity price increases on the output in the industrial sector? To assess this we need to examine both the importance of electricity in this sector in terms of cost shares and the composition of electricity demand in the industry at the time of price increases. Table 6.3 gives the cost shares and electricity consumption for the industrial sector.

Figure 6.1: Colombia: Energy Prices, 1984-85
(percentage p.a. in real terms)

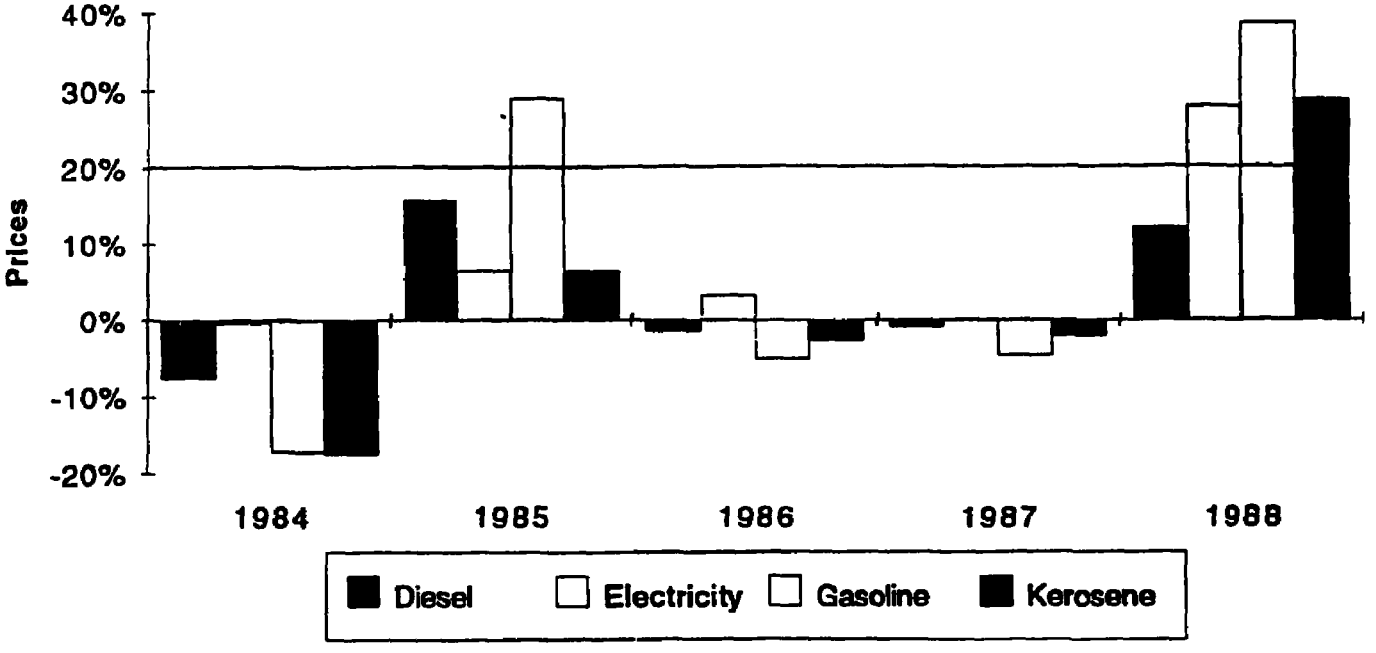


Table 6.2: Colombia: Average Rates by Sector - Total System and ISA, 1988*
(Col. Pesos/KWh)

Sector	1984	1985	1986	1987	1988
Residential	7.13	7.38	7.79	7.83	7.74
Commercial	18.63	19.81	21.23	22.86	22.52
Industrial	12.74	14.75	16.00	16.49	16.70
Official	10.42	11.92	13.24	14.02	14.38
Total system	10.35	11.38	12.20	12.65	12.56
ISA bulk tariff	5.38	5.96	6.09	6.74	6.77

* Interconnection Electrica S.A.

Table 6.3: Colombia: Energy Cost Shares and Electricity Consumption

Sector	Cost share*		Consumption (000' toe)	
	1985	1988	1985	1988
Iron and steel	6.81	5.47	91.8	142.4
Chemicals	4.16	3.67	114.0	188.9
Nonmetallic minerals	-	-	74.6	103.1
Transport equipment	1.17	1.36	31.9	28.9
Food	1.26	1.11	97.0	115.3
Paper and pulp	4.67	4.81	48.0	58.1
Wood	2.68	2.14	4.6	6.5
Textile	2.23	2.79	64.9	77.1
Total industry	-	-	529.8	723.6

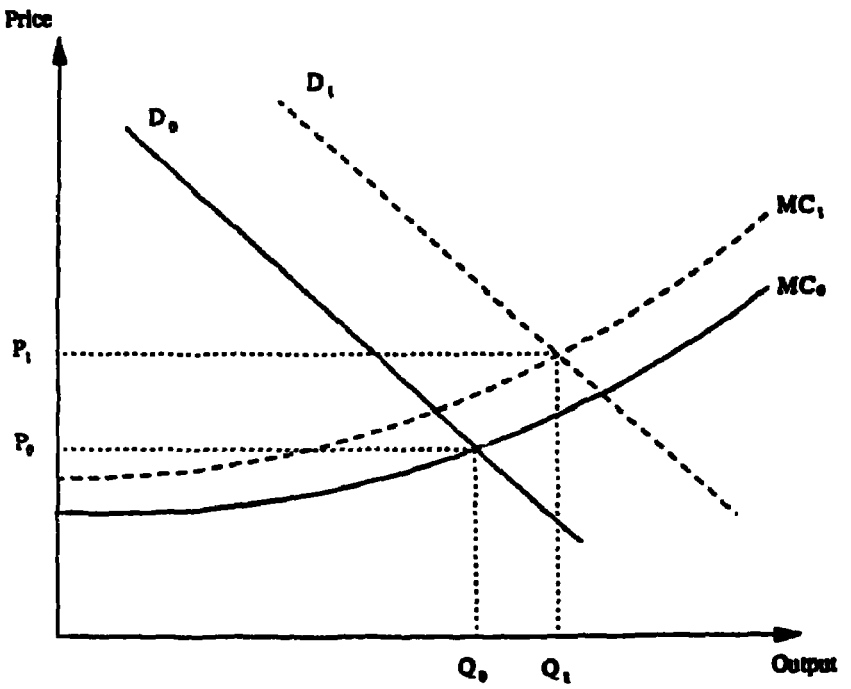
* Energy expenditures as a percent of gross output for 1985.

The industries listed in table 6.3 account for over 99 percent of electricity consumption in the industrial sector. It shows an increase in total demand for electricity in the industrial sector despite the price increase in 1985-86 and 1988. It also shows a fall in share of energy cost during this period, indicating some energy conservation in this sector. Given that major price changes during 1985 and 1988 covered both electricity and petroleum products, interfuel substitution would have been less important. The factor that would best explain the increase in demand for electricity is an increase in output in Colombia as a result of the wider stabilization program in 1986.[46]

The two most important elements of the stabilization program were devaluation of the real exchange rates to promote competitiveness and trade reforms such as removal of export restrictions and expansion of the duty exemption scheme, which were designed to enhance profitability in the export sector as well as efficiency of domestic import-competing sectors. It is reasonable to expect that some of the increase in cost due to adjustments in electricity prices would have been offset by the efficiency gains due to policy changes. However, the most important factor that would explain the increase in output would be the increase in demand for Colombian exports from the manufacturing sector. Figure 6.2 illustrates the likely response during this time period.

[46] See also the discussion of macroeconomic impacts.

Figure 6.2



This scenario would explain the response in the industrial sector at the time of an increase in electricity prices, the crucial factor being an expansion in demand for manufactures. A closer analysis of the period reveals that a distinctive feature of the 1986-87 policy reforms was the economic recovery of the manufacturing sector. Impacts of exchange rate policies and trade reforms were effective as manufacturing exports grew at an average rate of 19 percent per year. In addition there was an expansion in domestic demand due to growth in investment, mostly in the private sector as the economy recovered. Growth in investment accounted for nearly 30 percent of the increase in total demand. In view of these developments, it is not surprising that an increase in energy prices did not result in any output losses. The importance of the general economic environment for the success of energy price reforms is quite clear in the case of Colombia. The impact of electricity price reforms on demand for electricity was in line with an expansion in output. Electricity demand increased despite increase in prices.

Electricity Price Increases 1985-88: The Household Sector

Electricity prices for the residential sector have traditionally been much lower than prices for the industrial and commercial sectors. These differences, which have been justified mainly on socioeconomic grounds, have varied across different electricity utilities. For the first time, in 1986, formal guidelines were established for electricity tariffs for the residential sector. According to these guidelines the residential tariff consisted of two elements: a monthly fixed charge determined by the socioeconomic stratum of the consumer, and five blocks of energy consumption with increasing prices. Six socioeconomic strata were identified and fixed charges for each stratum were unified across the country. The block energy prices, however, were allowed to vary within an interval defined as a percentage of long-run average incremental costs. Table 6.4 tracks the development of these tariffs for the residential sector for different utilities.

Table 6.4: Colombia: Average Residential Rates by Sector and Major Utility, 1988 (Col. Pesos/KWh)

Utility	1984	1985	1986	1987	1988
EEEB	7.86	7.51	7.16	6.89	6.50
EEPPM	5.13	5.99	6.49	6.82	6.95
CVC	8.12	8.29	9.63	8.86	8.90
ICEL	6.40	6.61	6.98	7.41	7.40
CORELCA	8.9	9.17	9.94	10.22	10.16

As shown in table 6.4, the trend in electricity prices for the residential sector was not uniform across utilities. Except for EEEB, the utility serving the capital city of Bogota, there was an increase in electricity prices for most of the utilities. What were the impacts of these price increases on the welfare of the poor? Table 6.5 illustrates the welfare effects of the price changes for a household with an income of Col. Pesos 24000/month and consumption level equal to the average residential consumer of the second major utility, EPM, serving Medellin.

The welfare impact, defined as the loss in consumer surplus, was between -2.76 and -3.35 percent of the household monthly income. The relatively high-welfare impact is due to high household budget-share for electricity consumption (9%) as electricity is also used for cooking.

Table 6.5: Colombia: Welfare Effects of Electricity Price Changes, 1983-88

Price 1984 (Pesos/kWh)	5.13
Price 1988 (Pesos/kWh)	6.95
Consumption 1984 (kWh/month)	442
Consumption 1988 (kWh/month)	392
Income (Pesos/month)	24000
Welfare effect assuming elasticity of zero (percent)	-3.35
Welfare effect assuming elasticity of -.32 (percent)*	-3.16
Welfare effect assuming price elasticity of one (percent)	-2.76

Note: Price and consumption for EPM consumers.
* Loss in consumer surplus expressed as a percentage of total income.

As for the subsidy effect of price increases during 1985-88, prices in the residential sector were still subsidized, although the level of subsidies varied across different utilities. Table 6.6 gives the distribution of subsidies to the residential sector for different utilities.

Table 6.6: Colombia: Electricity Subsidies to the Residential Sector, 1988

Utility	Sales 1988 (GWh)	Share of Sales (%)	Average rate 1988 (US¢/kWh)	LRAIC (US¢/kWh)	Subsidy US$ Million
EEEB	2,639	23.8	2.19	7.34	135
EEPPM	2,050	18.5	2.32	7.34	103
CVC-CALI	1,477	13.3	2.97	7.34	65
ICEL (group)	3,362	30.3	2.47	7.34	164
CORELCA	1,569	14.1	3.40	7.34	60
Total	11,097	100	2.59	7.34	527

Source: World Bank (1989).

Macroeconomic Impacts

From 1986 to 1988, increases in consumer prices were relatively high and inflation peaked at 30 percent in the middle of 1988, although it declined to 28.1 percent by the end of the same year. Studies analyzing inflation in Colombia show that the major factors responsible for inflation in the past have been

excessive monetary growth, high capacity utilization, wage-push and devaluation. Two of these factors, namely, excessive monetary growth and wage-push are relevant in the present context. To the extent the fiscal deficits of the publicly-owned electricity sector are monetized, low electricity prices would lead to high fiscal deficits and thus increased money creation. The effect of an increase in electricity prices would in such a case have a dampening effect on inflation. From 1986 to 1988 deficits of the electricity sector declined from Colombian Pesos 81.5 to 55.7 billion. The revenue effect of electricity price changes was relatively positive. Assuming the price elasticity of demand for electricity equal to zero, had the price reforms not been implemented, the estimated shortfall in government revenues would have been equal to Col. Pesos 184.5 bill. or 4.36 percent of government revenues in the same year.[47] Table 6.7 summarizes selected economic indicators.

Table 6.7: Colombia: Selected Macroeconomic Indicators, 1984-88

	1984	1985	1986	1987	1988
GDP (Percent change p.a.)	3.4	3.1	5.8	5.3	5.7
Current revenue (C. Pesos bill.)	1261	1651	2384	3229	4233
(Percent change p.a.)	23	31	41	35	31
Change in Price Index (% p.a.)					
General price level	22.2	24.9	29.2	22.8	27.0
CPI	16.1	24.0	18.9	23.3	28.1
WPI	18.3	24.9	22.0	25.2	28.3

Another impact of electricity prices on inflation is the extent to which such an increase triggered wage inflation via the labor unions' attempt to maintain real wages. A crucial assumption here is a downward rigidity of real wage. However, there is little evidence to support this hypothesis. On the contrary, the contraction in real wages observed across all sectors in 1985 indicates wage flexibility in the Colombian labor market. Although in 1987 wages had recovered to their 1984 levels, there is little evidence to support the hypothesis of an wage-push led by electricity price increases during the period 1986-88. The main reason for inflation in Colombia during 1986-88 was growing fiscal deficits in 1987,

[47] See annex 1.7 for details related to calculation of revenue effects. See also, discussion of macroeconomic impacts in Chapter 1.

which were partly monetized. In this respect, an increase in electricity prices would have only dampened the situation. However, there were other factors involved such as the slow-down of trade liberalization, increasing demand for new capital from the private sector, a drought in early 1988, and restrictive agricultural trade policy that resulted in an increase in food prices.

Growth in output was relatively stable between 5 and 6 percent during 1986-88. This was an improvement over annual rates of around 3 percent during 1984-86. The scenario during this period depicts growth with inflation. However, in the long-term this is not sustainable. Past studies for Colombia show an inverse relationship between inflation and growth and control of inflation becomes the most important policy issue. Further control of fiscal deficits will remain a first priority and reduction of the power sector deficits via improved revenue raising through increased prices will be an important issue for the 1990s.

Annex 6.1: Colombia: Evolution of the Foreign Debt of the Power Sector

	DEBT mil.US$ (Year end)	INCREASE (Percent)	SHARE IN PUBLIC SECTOR DEBT (Percent)
1980	860.5	22.8%	20.6%
1981	1,056.9	44.3%	18.7%
1982	1,524.8	44.3%	22.4%
1983	1,933.7	26.8%	24.6%
1984	2,457.4	27.1%	27.8%
1985	2,972.1	20.9%	26.2%
1986	3,572.0	20.2%	29.3%
1987	3,973.8	11.2%	32.0%
1988	4,214.3	6.1%	28.5%

Data Sources

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7. TURKEY: OIL AND ELECTRICITY PRICE INCREASES 1986-88

Introduction

Turkey is among the few developing countries that are members of the OECD. It has a population of 56.1 million and GNP per capita of US$ 1630, placing it amongst the lower middle-income countries.[48]

The Economy

Turkey has traditionally been one of the fastest growing semi-industrialized developing economies of the post war era. During the period 1947-77, growth rates of GDP averaged over 6 percent despite the fact that the country was a net-oil importer and had not received substantial development aid. Economic growth during this period was cyclical; each of three similar cycles started with a period of rapid industrial growth and ended with a major foreign-exchange crisis and devaluation.[49] Economic policy in Turkey during this time was mostly inward-looking import-substituting industrialization with the state as an active regulator and producer via state-owned enterprises. Turkey was particularly affected by a chronic external imbalance and the oil price shocks and global recession during the 1970s. The situation was further worsened by expansionary economic policies during 1974-77. High growth rates of over 6 percent in real terms were achieved at the cost of a surge in short-term foreign debt, which ended in a debt-crisis by the end of 1977. A partially successful attempt was then made by the ruling Republican Peoples Party government to alleviate the situation via debt rescheduling and increased concessional and commercial external financing.

The 1980s began with a stabilization program established by the then ruling Justice Party, which led to a three-year agreement with the IMF. The scope of the program was further widened, first by the military government after the coup in September 1980 and later on by the Motherland Party after December 1983. Inception of this program marked a shift in Turkish economic policy. The inward-looking import substitution was replaced by an export orientation. The earlier regulatory framework was replaced by a more market-oriented economic environment. Policy reforms involved maxi devaluation of Turkish Lire, abolition of price controls, liberalization of the financial system and austerity in government

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[48] Data for 1990.

[49] Dervis, K . et al. (1982), General Equilibrium Models for Development Policy, Cambridge University Press, London.

expenditures. An important objective was to improve the chronic balance of payments situation and control inflation. It was clear that sustained growth in the medium- and long-run would require greater reliance on domestic resource mobilization and efficiency in use of scarce resources.

In this context, improvements in the management of the energy sector were crucial to address both the high dependence on imported petroleum and the large participation of the state-owned enterprise in this sector. Sectoral policy focussed on reducing dependence on imported petroleum by first emphasizing development of indigenous energy resources, mainly lignite and electricity, and then achieving greater efficiency in the use of energy resources. Pricing policies were identified as an important instrument to encourage greater efficiency in use of existing energy resources. However, the country didn't implement widespread increases in energy prices until 1987.

The Energy Sector

Structure of Energy Demand

Net commercial energy consumption in Turkey[50] in 1985 was estimated to be 23.94 million toe. The most important source was petroleum (62.6%) followed by coal (27%) and electricity (10%). Users of commercial energy were industry (38%), transport (28%) and residential sectors (23%), the rest being consumption by agriculture and commercial services sectors. Nearly half of the demand in the industrial sector was met by petroleum products and the rest by coal (37%) and electricity (17%). Consumption in the transport sector was almost exclusively petroleum products. In the residential sector half of the consumption was satisfied by coal followed by petroleum products (40%) and electricity (8%). Table 7.1 gives the structure of commercial energy demand for 1985 prior to the energy price changes, and for 1989 when price reforms had been implemented.

Energy Policy and Prices

Turkish energy policy during the 1980s emphasized reduced dependence on imported oil and expansion in domestic lignite and electricity output. During the decade between 1980 and 1990, for example, the government planned an eight-fold increase in lignite production and tripling of hydro-power capacity. During the first half of the decade, emphasis was placed on the supply side. Nearly 40 percent of public investment, equivalent to 3 percent of GDP, was attracted to the energy sector in 1984. However,

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[50] The non specified category "other solid fuels is not included in the following discussion.

these plans were too ambitious and diversified. Problems of delay in project implementation and frequenttechnical failures resulting in shortages started in the early 1980s. The government then reconfirmed its plans under the Fifth Five Year Plan (1984-89) to emphasize the role of demand-side measures and pricing policies in particular. The domestic energy price changes during 1987-89 were a part of this sectoral policy under the revised plans. Figure 7.1 shows the changes in domestic energy prices during 1986-89.

Table 7.1: Turkey: Commercial Energy Consumption by Major Sectors 1985 and 1989 (million toe)

	Coal	Petroleum products	Gas	Electricity	Total
Total final consumption	6.38 (7.91)	15.05 (19.29)	0.06 (0.44)	2.45 (3.55)	23.94 (31.19)
Industry sector	3.46 (4.68)	4.12 (5.15)	0.03 (0.41)	1.58 (2.21)	9.18 (12.45)
Transport sector	0.13 (0.03)	6.47 (8.74)	- -	0.02 (0.03)	6.62 (8.80)
Other sectors	2.80 (3.20)	3.68 (4.56)	0.03 (0.03)	0.85 (1.30)	7.36 (9.09)
Residential	2.80 (3.20)	2.20 (2.83)	0.03 (0.03)	0.43 (0.71)	5.45 (6.77)
Non-energy use	- -	0.78 (0.85)	- -	- -	0.78 (0.85)

Note: Figures in bracket are for 1989.
Source: IEA (1991).

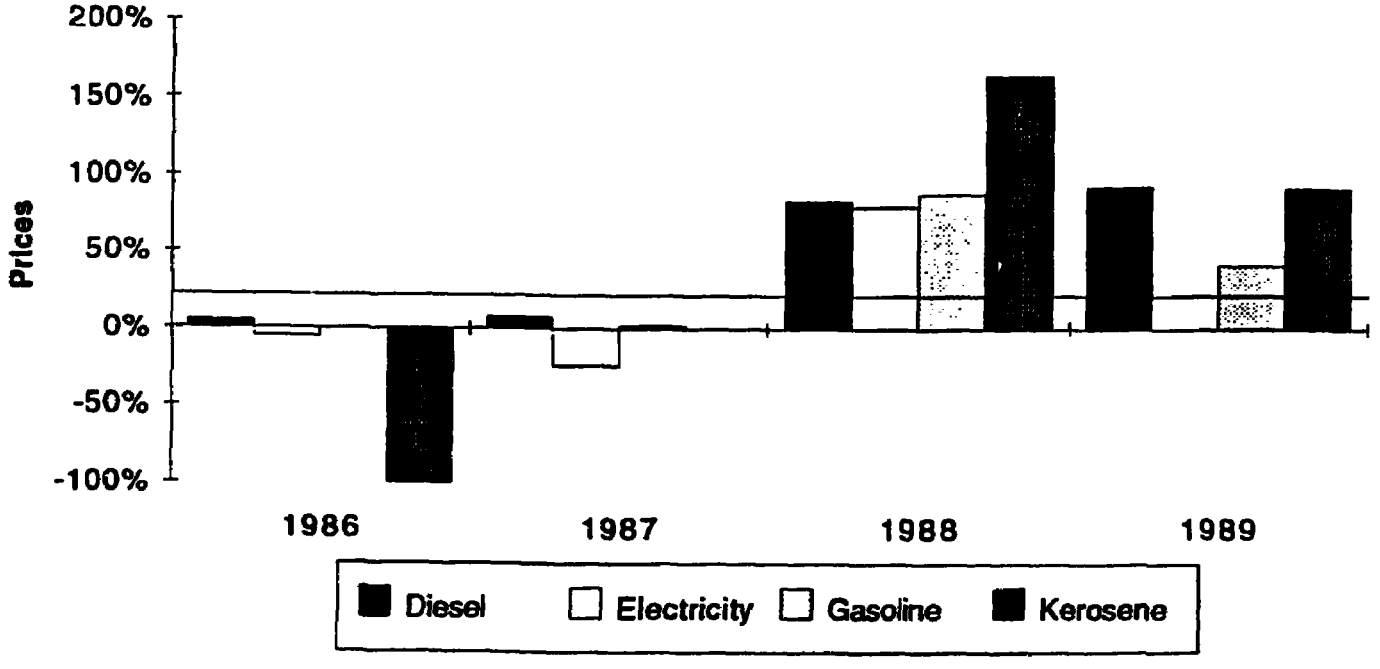
Effects of Energy Price Changes

Diesel and Electricity Price Changes 1986-88: The Industrial Sector

As figure 7.1 shows, Turkey experienced real domestic energy price changes from 1986 to 1989. Both electricity and oil product prices were increased during this period. What was the impact of these energy price increases on the output in the industrial sector? The output impact of an energy price increase

would depend, in the first instance, on the share of energy costs in the total cost of production in the various subsectors of the industrial sector. In particular, one would expect greater output effects for the energy-intensive subsectors. Table 7.2 gives the changes in output of selected industries during the period 1986-90.

Figure 7.1: Energy Price Changes in Turkey
(percentage p.a. in real terms)



A marked downturn in growth is seen for the years of adjustment, 1988-89, as can be expected. Also, industries that generally are less energy-intensive, such as food and textiles, fare better than sectors such as machinery and transport, basic metals, paper and printing and forestry products, all of which experience declines at least one of the two years. Importantly, output rebounded in 1990, and markedly more so for the sectors with the lower growth rates in 1988-89.

What was the impact on energy demand in the industrial sector during this period? Of particular importance is the effect on demand for petroleum in the industrial sector. Petroleum consumption as a share of total energy consumption by the industrial sector fell from nearly 45 percent in 1985 to 41 percent by 1989 and natural gas consumption increased. Share of all the other fuels remained relatively stable during this period, so the change in petroleum product prices was successful in terms of the overall Turkish energy policy objective to reduce dependence on imported oil.

Another important policy issue related to the increase in petroleum product prices is the relationship between domestic and border prices. Figure 7.2 shows the relationship between the domestic and border prices for diesel during the 1980s.

Table 7.2: Turkey: Changes in the Production of Selected Industrial Commodities (percent)

	1986	1987	1988	1989	1990
Total manufacturing	10.9	10.7	0.9	2.1	9.5
Food, beverages, tobacco	-0.6	3.5	4.5	6.7	6.8
Textile, clothing, leather	11.9	8.9	1.8	3.2	2.3
Forestry products	10.1	4.4	-2.2	2.0	17.4
Paper and printing	6.7	14.1	-7.3	2.6	15.3
Chemicals, petroleum	12.4	15.1	2.6	0.4	3.3
Soil products	16.3	12.9	6.1	4.7	3.8
Basic metals	18.5	12.1	-0.2	1.2	16.8
Machinery and transport equipment	10.9	8.5	-6.7	-1.2	31.8
Other manufacturing	n.a.	11.4	-17.4	72.9	34.3

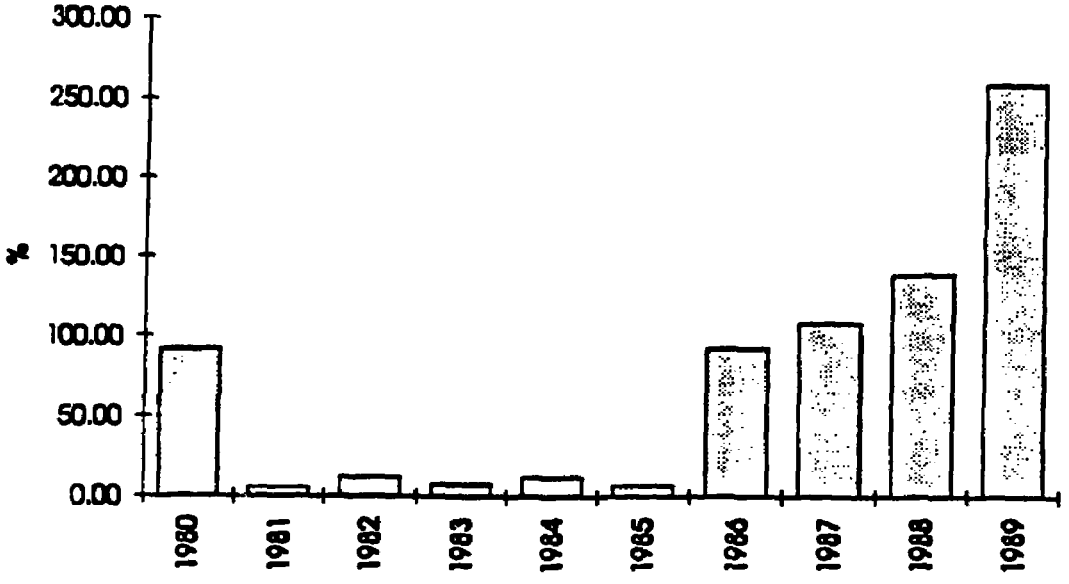
Source: OECD, Economic Surveys, Turkey, 1991-92.

As figure 7.2 shows, domestic diesel prices during 1981-85 were a bit over the border prices. The price changes during the second half of the 1980s resulted in domestic prices that were substantially higher than the border prices, thereby mobilizing much-needed revenue for the government.

Electricity Price Change 1988: The Household Sector

The most important sources of commercial energy for Turkish households are coal and electricity, followed by LPG and kerosene. The share of commercial energy expenditures for the same income groups is higher for urban households as compared to rural households. As expected, the share of energy expenditures falls as income increases, both for rural and urban areas.

Figure 7.2: Turkey: Differences between Domestic and Border Prices for Diesel Subsidy (-), Tax (+)



Given the relative importance of various energy sources for Turkish households, the changes in electricity prices during 1988 are significant. Figure 7.3 gives the electricity expenditure shares for various groups of households.

Figure 7.3: Turkey: Household Income and Electricity Expenditure Shares, 1987

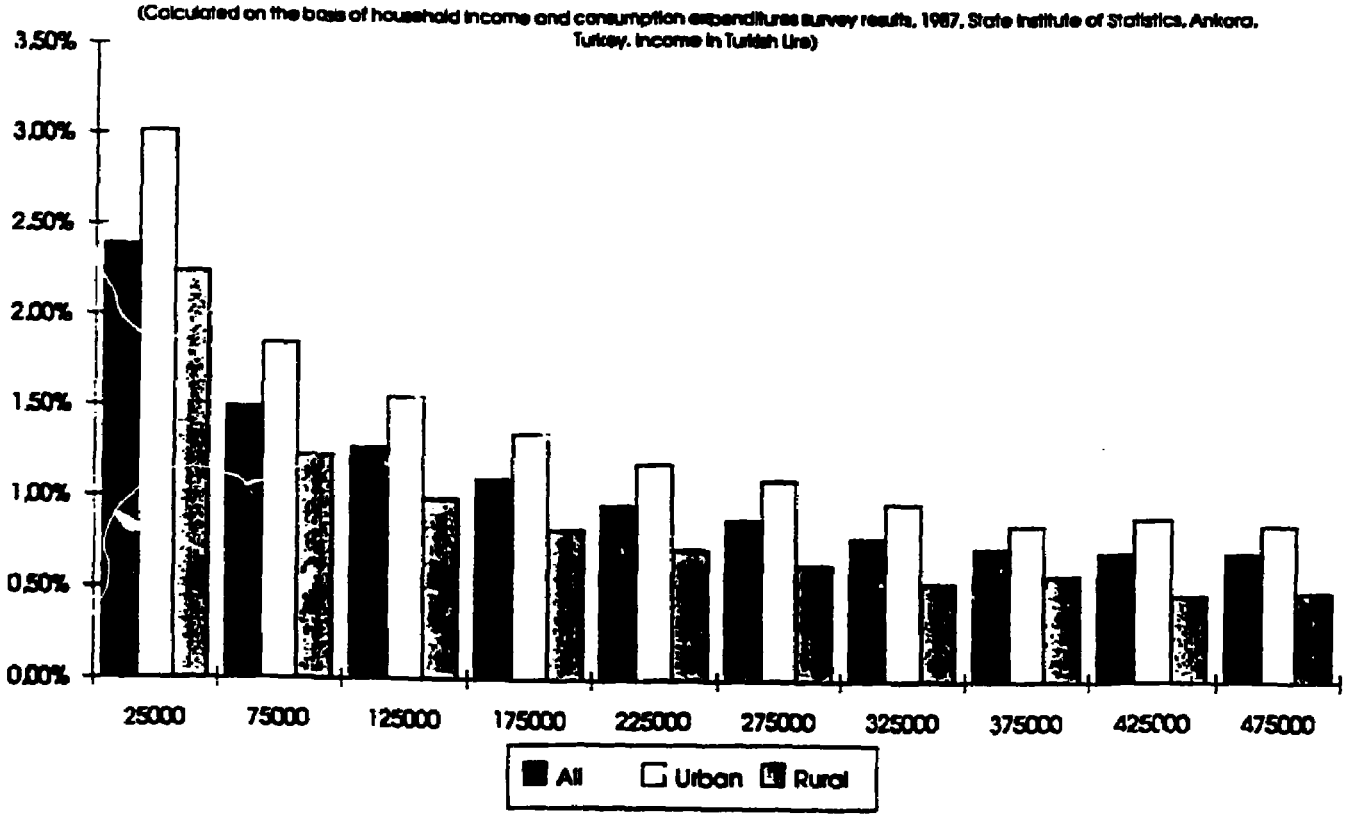


Table 7.3 shows estimated loss in consumer surplus for households disaggregated on the basis of total household expenditures. The estimates are made using a "worst case" price elasticity of 0, giving an upper bound. Welfare loss is calculated for the electricity price change from 1987 to 1988 and is expressed as a percentage of total expenditures for the relevant group of households.

Table 7.3: Turkey: Household Monthly Income and Estimated Welfare Loss due to Domestic Electricity Price Changes, 1987-88
(income thousand TL)

Income group	Urban (%)	Rural(%)	All(%)
0 - 49.9	2.4	1.8	1.9
50 - 99.9	1.5	1.0	1.2
100 - 149.9	1.2	0.8	1.0
150 - 199.9	1.1	0.7	0.9
200 - 249.9	1.0	0.6	0.7
250 - 299.9	0.9	0.5	0.7
300 - 349.9	0.8	0.4	0.7
350 - 399.9	0.7	0.5	0.6
400 - 449.9	0.7	0.4	0.6
450 - 499.9	0	0	0.6

Note: Loss in consumer surplus expressed as a percentage of median household income. The income groups given account for nearly 82 percent and 89 percent of the urban and rural households respectively. The figures are based on an assumption that price elasticity of demand is equal to zero and thus represent a "worst case" scenario.

As the estimates above show, welfare effects vary according to the household group. In general, low-income households suffer a greater welfare loss as compared to the higher-income households. This is due to the relatively higher share of electricity in total expenditures of the low-income groups. Also, urban households loss of welfare is slightly above that of the rural households as their expenditure shares for electricity are generally higher.

In terms of electricity subsidies, the average price of electricity during 1986-88 was maintained at around 6 US cents per kilowatt hour. This was relatively close to the long-run incremental cost of power system expansion in Turkey. In this respect, Turkey was one of the few developing countries with no subsidy for domestic electricity price during the period under study.[51]

[51] The other developing countries in this group were Ethiopia, Gambia, Ivory Coast, Kenya, Madagascar, Mali, Mozambique, Fiji, Korea, Malaysia, Papua New Guinea, Philippines, Cyprus, Jordan, Morocco, Yemen AR and Yemen PDR. See World Bank (1990), Review of Electricity Tariffs in Developing Countries During the 1980s, Energy Series Paper No. 32, Energy and Industry Department Working Paper, Washington, DC.

Macroeconomic Impacts

During 1986-88 GDP growth was relatively high, around 7 percent. Growth maintained through expansionary fiscal policies during this period resulted in growing deficits and inflation. Prior to elections in September 1987, rising prices were kept in check by delaying the adjustment of administered prices and relying more heavily on domestic borrowing instead of monetizing the deficits. However, after the September parliamentary elections several increases in taxes and administered prices were implemented to improve government finances. During this period the energy price index increased by over 41 percent, whereas the general the consumer price index increased by over 75 percent. Table 7.4 summarizes the change in selected macroeconomic indicators.

However, other factors contributed to rising inflation. During 1980-87 real wages in Turkey declined by 30 percent. By 1985 real wages in the manufacturing sector had returned to their 1965 level. As a result, wage payments as a share of non-agricultural income had declined from nearly 52 percent in 1977 to 22 percent by 1985. The fall in r l wages was an outcome of political measures (restrictions on trade union activities during this period) and fiscal constraints on the public sector that were an integral part of the stabilization and adjustment program implemented in Turkey during the early 1980s. By 1987 and early 1988, the gradual erosion of real wages began to surface in the form of limited strikes and boycotts.

Table 7.4 Turkey: Selected Macroeconomic Indicators, 1986-89
(percent changes p.a.)

	1986	1987	1988	1989	1990
GDP (growth)	7.4	6.4	4.6	0.6	8.2
Government revenues*	18.6	19.1	18.5	20.1	22
Change in Price Index (% p.a.)					
Wholesale price (Mining)	13.6	35.7	69.9	84.1	48.7
Wholesale price (Agriculture)	27.1	29.7	50.9	81.4	70.6
Wholesale price (Energy)	37.7	20.5	41.1	63.8	56.5
Wholesale price (Manufacturing)	32.6	33.6	77.7	64.7	46.9
CPI	34.6	38.9	75.4	69.6	60.3
Food	30.4	39.8	71.2	66.4	64.3
Housing	—	—	58.7	70.2	n.a.

*Share of GDP.

Subsequent lifting of some of the restrictions on trade union activity in early 1988 allowed even more labor discontent to surface. The two-year public sector wage agreement between the government and Turk-Is (the major trade union) in early 1988 was based on the understanding that further erosion of real wage would be avoided. It also opened up some real wage increases. A 38 percent increase in wages in January 1988 was followed by a further 29 percent increase in the same year. An increase of 20 percent and 16 percent was stipulated for January and July 1989, respectively, and in case inflation turned out to be higher than expected provisions were made for supplementary wage increases to protect real wages. The legal minimum wage was also increased by 50 percent in July 1988. Private sector wage increases were generally above those in the public sector and in some cases reached 100 percent.

As regards the revenue effects of price reforms, assuming unit elastic demand for diesel and kerosene, had the price reforms not been implemented during 1986-88, the estimated shortfall in revenues in 1988 would have been equal to TL 4805 billion or close to a quarter of central government revenues in the same year.[52] However, domestic diesel prices were already above the border prices before the price increases. As planned, the increase in prices increased government revenues at the cost of higher-level distortions in these prices.

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[52] See annex 1.7 for details related to calculation of revenue effects. See also discussion of macroeconomic impacts in Chap. 1.

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